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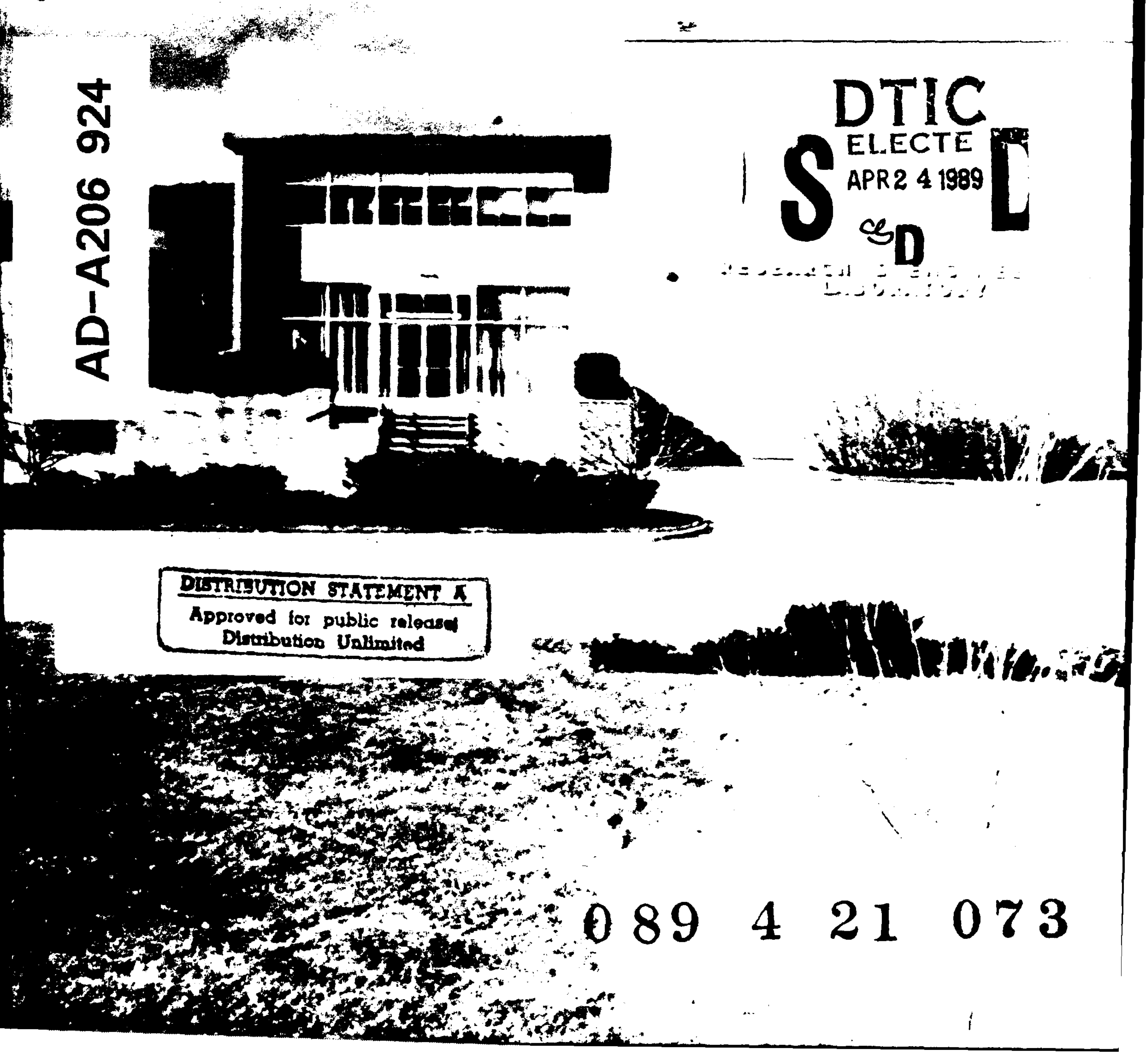
CRREL TECHNICAL PUBLICATIONS

Supplement
1 January 1976 to 1 September 1986



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US Army Corps of Engineers

Cold Regions Research &
Engineering Laboratory

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THE COLD REGIONS RESEARCH AND ENGINEERING LABORATORY

In nearly half the land of the Northern Hemisphere, the cold of winter freezes the earth and covers it with ice and snow. Low temperatures continue throughout the year in much of the Arctic and Antarctic, perpetually challenging the men and women who live and work there.

To adapt to the environmental conditions of these cold regions, we must fully understand their special characteristics. We must determine how the cold affects our activities and how our civilization in turn affects the cold regions. We must also learn how to adjust to the extreme changes that take place between summer and winter seasons.

Gaining this knowledge through scientific and engineering research, and making the results available to governmental, military and other public organizations, is the job of CRREL—the Cold Regions Research and Engineering Laboratory of the U.S. Army Corps of Engineers.

THE MISSION

CRREL is a federal laboratory with a special mission—to understand the characteristics of the cold regions of the world and to apply this knowledge to make it easier for people to live and work there.

CRREL was created in 1961 by combining two existing Corps of Engineers organizations: the Arctic Construction and Frost Effects Laboratory and the Snow, Ice and Permafrost Research Establishment. Between them the two labs brought together at CRREL a group of research personnel with expertise in virtually all aspects of cold regions science and technology.

As a Corps of Engineers lab, CRREL has the advantage of the Corps' long-held tradition of service to the nation. CRREL research facilities and expertise are available to any federal, state or local agency that has need for them, and work has occasionally been done for private organizations as well. This approach helps to account for the diversity of research activities at CRREL and the overall character of the laboratory. Each research or study project, whether funded by the Corps of Engineers or other agencies, has a well-defined scope and objective chosen by its sponsor.

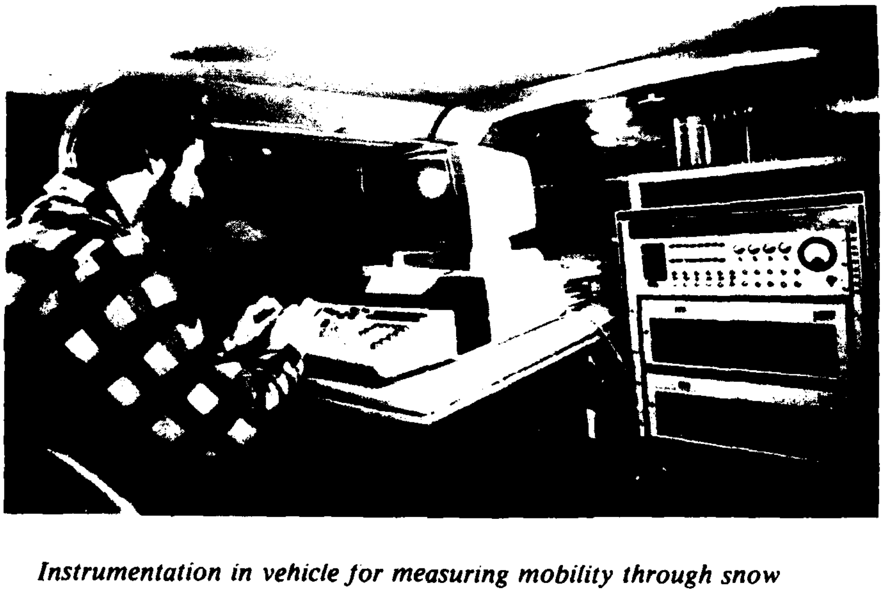
Sonar profiling of pressure ridge keel in Beaufort Sea.

Scanning electron microscope

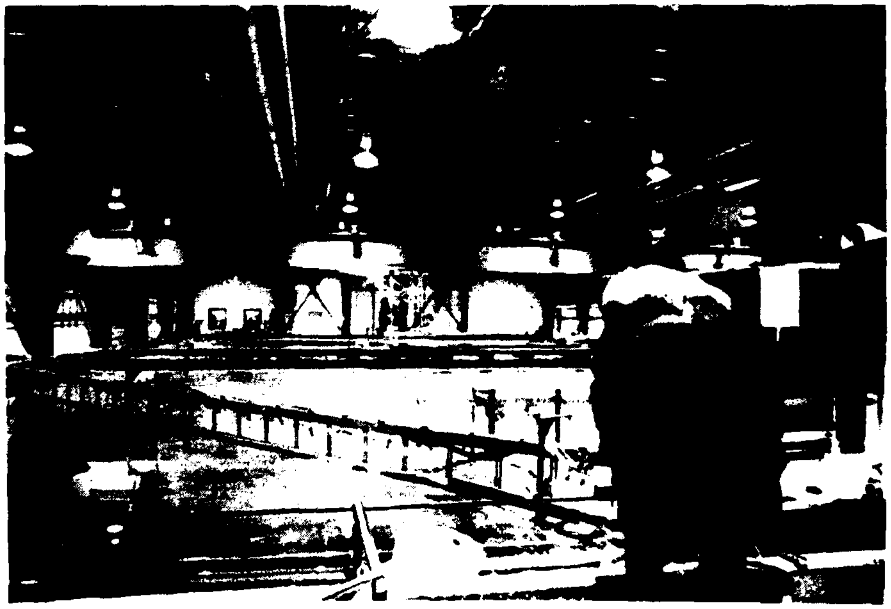
CRREL PERSONNEL AND FACILITIES

Cold regions science and technology is a specialty that cuts across traditional disciplinary lines. As a result, the CRREL staff is quite diverse, with specialists from many different backgrounds. The total staff numbers about 300, including more than 100 research scientists and engineers. These researchers include civil, hydraulic, electrical, chemical and mechanical engineers, and agronomists, biologists, chemists, geographers, geologists, geophysicists, glaciologists, meteorologists, physicists and soil scientists. In addition, scientists and engineers from other institutions often pursue long-term research projects at the laboratory.

The support staff at CRREL also comprises a variety of professionals. Administrators, support engineers, technicians, computer specialists, photographers, illus-



Instrumentation in vehicle for measuring mobility through snow



Model of ice control structure in Ice Engineering Facility

trators, editors, typesetters, secretaries and dozens of others help to keep the laboratory running smoothly. These personnel often bring their expertise outside CRREL when needed for the research projects of other organizations.

The physical facilities that support the CRREL research effort really merit the description "unique." The main laboratory building contains 24 coldroom laboratories, many capable of achieving temperatures of -30 °C or below. Along with the cold laboratories are chemistry, physics, soils and electronics labs with highly specialized equipment for research at below-freezing temperatures.

In 1978 an Ice Engineering Facility was completed that is devoted to the study of problems caused by ice in waterways. This lab, acclaimed as the finest in the world, permits research that will lessen the effects of winter on the nation's waterways. In the Ice Engineering Facility is a refrigerated modeling area in which scaled-down rivers, harbors and lakes can be studied, a tilting refrigerated flume for river ice research, and a large test basin in which ice force problems can be studied at nearly full-scale dimensions.

The Frost Effects Research Facility, completed in 1985, is be devoted to the study of frost action in soils. This laboratory contains refrigerated research areas for below-freezing testing of pavements, foundations and underground utilities, and permits the study of destructive freeze–thaw cycles in a controlled setting.

CRREL also has an Alaskan Projects Office at Fairbanks with a research and supporting staff to aid in conducting CRREL's many projects in Alaska. In Fox, Alaska, CRREL excavated and helps to maintain a research tunnel in permafrost, the only facility of its type in the Western World.

CRREL RESEARCH

Snow and ice

Basic to the understanding of the cold regions is the study of snow and ice. Because they change with the characteristics of their environment, snow and ice are far more complex than most people realize.

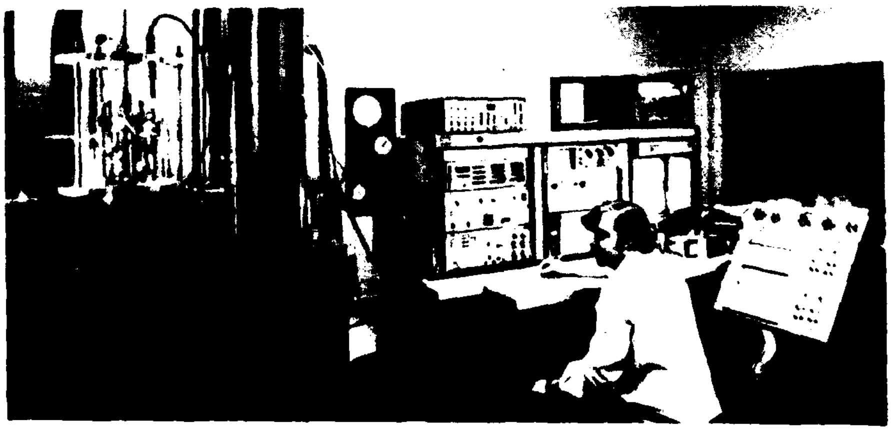
Drilling through ice in Antarctica

Examining an ice core

CRREL scientists and engineers have extensively studied both freshwater ice and sea ice. They have extracted drill cores from ice caps, icebergs and sea ice floes to scrutinize them with a number of analytical methods. Crystalline structure, which can greatly affect strength characteristics, has been investigated microscopically and with specialized radar devices. The minute quantities of certain elements in ice cores have been determined to the precision of 1 part per billion, and electron micrographs have revealed trace particles in snow crystals under thousands of powers of magnification.

The accumulation of ice on helicopter blades, ship superstructures, and communications antennas is a problem that has received considerable attention. CRREL researchers have explored the basic mechanisms that cause the ice accumulation and have developed methods for its prevention.

Ice can be a source of support for buildings, vehicles and machinery placed over water bodies or on glacial ice. But ice can also be a source of destruction when sheets of sea ice crush against navigation structures or river ice smashes against bridges. To



Strength testing machine

make use of its positive aspects and to guard against its destructive effects, the engineering properties of ice must be thoroughly known. Strength testing of ice samples and the measurement of ice forces on instrumented structures has revealed much information about the basic properties of different types of ice.

Snow also takes many different forms, depending on temperature, age, and snowpack pressure. In glaciers, snow is transformed by the pressure of the accumulating snowpack first into a consolidated substance called firn and then eventually into ice. The massive ice sheets—such as those in Greenland and Antarctica—were formed in this way, and examination of the drill cores has revealed thousands of years of climatic history.

Research on mountain glaciers has helped to explain the forces that were working thousands of years ago when much of the Northern Hemisphere was covered with ice. The accumulation and breakup of the massive Antarctic glaciers have been carefully studied, as any fluctuation could drastically affect the global climate and the level of the world's oceans. Even the effects of the eruptions of Mt. St. Helens on its glaciers have been observed by CRREL scientists.

Melting of snow and the subsequent runoff are important to flood control and hydroelectric power production. Predictive models developed for estimating snowmelt and runoff have compared favorably with results from test sites. Eventually this work may result in accurate methods of predicting the amount and rate of spring runoff into watersheds throughout the country.

Frozen ground

Along with snow and ice, the other major natural material in cold regions is frozen ground. This material is even more complex, as it can take a multitude of forms. In the Far North, permanently frozen ground or *permafrost* is of particular concern because ice-rich permafrost will melt and settle if seriously disturbed. In virtually all areas with subfreezing temperatures, frost heaving can be a very destructive force to roads, airfields, pipelines, and all types of foundations.

An extensive effort has been made to understand the basic mechanisms of frost heaving so that this phenomenon can be reliably predicted. Although heaving can be

Installing a temperature-monitoring system in ground along trans-Alaska pipeline haul road prevented by placement of soils that permit sufficient drainage, these soils are becoming increasingly scarce and expensive in many areas. Special techniques, such as surrounding problem soils with water-resistant membranes and precisely classifying soils with marginal frost susceptibility, promise to reduce both construction costs and potential for frost damage.

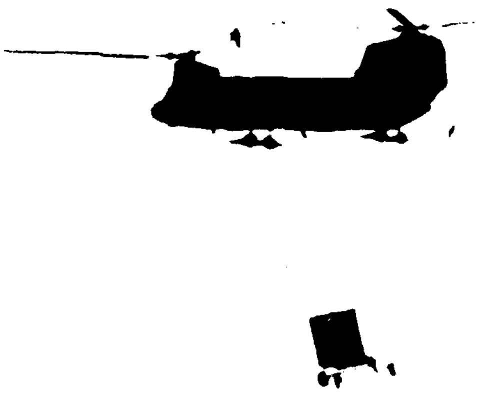
As with snow and ice, the mechanical properties of permafrost and seasonally frozen ground must be well understood before construction on these materials can take place. A number of laboratory and field tests have been devised to determine the moisture content and the frost-susceptibility of soils. In permafrost regions, an extensive program has sought to determine the ground ice content at substantial depths by electromagnetic methods and core drilling. CRREL researchers have helped to discover the characteristics of the permafrost beneath the Beaufort Sea near the oil fields at Prudhoe Bay, Alaska.

Cold regions construction

Among CRREL's first accomplishments was the design of airfields and living facilities in Greenland and Antarctica. This emphasis on cold regions construction has actively continued since that time. Major accomplishments have been the moving of a 3300-ton DEW Line station in Greenland onto a new and more stable foundation, and assistance in preparing design and installation procedures for the thousands of piles that support the aboveground portions of the trans-Alaska pipeline.

The design of roads and airfields has received particular emphasis. Experimental roads in New Hampshire and Alaska have tested new building techniques for cold regions. A study of the "haul road," built to bring materials to construction sites along the trans-Alaska pipeline, has shown the 360-mile-long road's response to the harsh northern climate and its effects upon the surrounding environment. In remote areas of Alaska, construction of airfields that are insulated from the permafrost has prevented disturbance of the ground ice and deterioration of the tundra.

Measuring movement of trans-Alaska pipeline



Air-transportable shelter

CRREL engineers have designed an air-transportable shelter for use in severe cold regions, and have conducted a long-term program on the correct design of roofs in heavy snowfall areas. From an extensive statistical analysis, a method of estimating roof snow loads for any area in the United States has been developed. In one application of their expertise, CRREL engineers determined the roof load at the time of the collapse of the huge roof of the Hartford, Connecticut, Civic Center.

Other CRREL construction-related research has investigated the use of special asphaltic paving mixtures and concretes that can be placed at low temperatures. Blasting techniques for use in permafrost and on ice have been developed. And CRREL engineers have worked with several agencies in remedying the detrimental effects of cold weather on existing facilities. In particular, one program found better ways to repair potholes in northern roads.

Land transportation

In areas where no roads exist or where they are clogged with snow, land transportation with conventional vehicles can be extremely difficult or virtually impossible. This problem has been addressed in two ways. First, methods are being developed for predicting the performance of wheeled and tracked vehicles in snow so that their design can be improved.

Laying asphalt concrete at Deadhorse Airfield, near Prudhoe Bay, Alaska

A second approach was a study of the use of surface-effect vehicles ("hovercraft") in arctic regions. These vehicles, modified for arctic use, were found to work well over snow-covered tundra, and they had little effect on the underlying permafrost.

Environmental protection

Due to the instability of ice-rich permafrost and the short growing season in northern regions, environmental protection is crucial. Several CRREL researchers have taken part in studies of the climate and biology of northern Alaska that are providing the first detailed documentation of this environment.

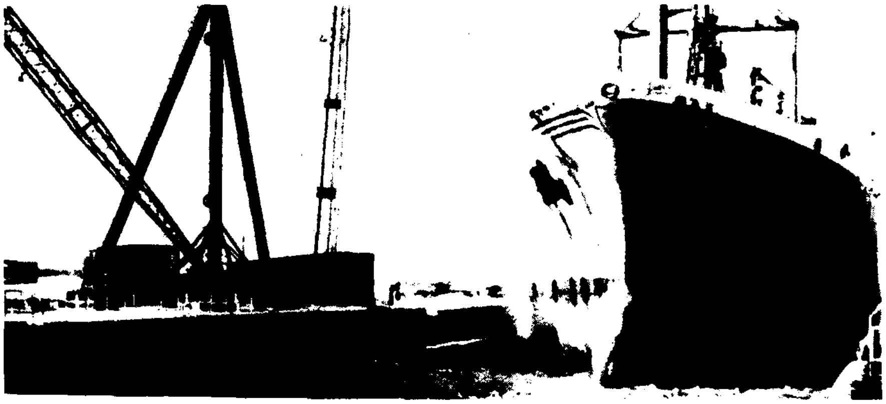
The impact of civilization has also been closely monitored. A long-term study has shown the effects of artificial oil spills on vegetation in a controlled environment, and the clean-up methods for spills along the trans-Alaska pipeline have been carefully observed to determine their effectiveness.

Restoration of areas damaged by construction activities has been documented and strategies developed to speed recovery. CRREL scientists have monitored erosion control and restoration activities along the entire trans-Alaska pipeline and on test slopes in New Hampshire and Alaska. Procedures for mapping wetlands through aerial photography and satellite imagery are being developed as part of a nationwide Corps of Engineers land use inventory. Similar remote sensing methods have assessed shore erosion in the Great Lakes and at Cape Cod and determined the potential environmental impact of construction projects in Alaska and northern Maine.

A multimillion dollar research program on improving methods for the land treatment of wastewater has been completed. Land treatment renovates municipal wastewater in a scientifically controlled manner to maximize the removal of waste substances and to minimize environmental effects and energy costs. The land treatment research program has placed this new technology on a firmer engineering basis so that millions of dollars will be saved in the construction and operation of new systems.

Sampling wastewater applied to a land treatment system

Blasting an ice jam.



High flow bubbler system (foreground) to keep ice from entering lock

Ice engineering

CRREL's Ice Engineering Facility has already been used in a variety of ways to improve winter navigation in cold regions. Studies of model icebreakers, conducted in the large refrigerated test basin, have resulted in devices that keep ice from damaging the ships' propellers. Studies of the interaction of moving ice sheets with test structures have helped to explain the destruction of offshore navigation facilities and to formulate new designs.

Refrigerated flume studies have resulted in methods for minimizing ice accumulation at dams and water intakes. Large-scale modeling of ice control structures in the Ice Engineering Facility's research area has demonstrated how existing structures can be modified and new ones designed to help protect shipping in ice-clogged northern rivers. As ice jams cause serious flooding each year in northern communities, the mechanics of ice jamming have received considerable attention so that this phenomenon can be prevented or controlled.

Various methods of keeping navigation locks free of ice have been devised to help extend the navigation season of the upper Ohio River system and St. Lawrence Seaway. The development of underwater air bubblers to keep navigation channels open has been applied extensively in northern harbors and navigation facilities.

Energy conservation

Due to the large heating requirements of buildings in cold regions, several projects have focused on conserving energy while maintaining comfortable living conditions. Infrared sensing devices have been used extensively to detect heat losses and wet in-

Checking heat flow data

sulation. From these infrared surveys, recommendations can be made as to how to most cost-effectively improve the thermal performance of a building's walls and roof.

Heat pumps for reclaiming waste heat from industrial cooling water have been studied and used to heat two buildings at CRREL. A method of analyzing the thermal losses from heat distribution systems has helped to maximize the efficiency of centralized heating systems, and a project in Alaska has assessed the use of waste heat for improving agricultural production in the Far North.

Military operations

To aid the Army in preparing for military action in cold regions is one of CRREL's continuing concerns. Field tests have shown that snow fortifications can be used for stopping small arms fire, and an extensive program has contributed to the design of a baseplate for a lightweight mortar.

Currently, CRREL is coordinating extensive tests on the effects of winter weather on the electro-optical guidance systems used in modern weapons. The test program will lead to an understanding of the performance of these systems during heavy snowfall and other adverse weather conditions. Another program is examining the effects of the cold regions environment on land mines.

Mine sensitivity test

CRREL library

TECHNICAL INFORMATION

Since scientific and technological research depends on the effective transfer of information, CRREL has a very active publication program. CRREL publishes approximately 100 technical reports each year, along with a general-interest newsletter. In addition, CRREL maintains a current international bibliography of available cold regions publications entitled the *Bibliography on Cold Regions Science and Technology*. Approximately 140,000 publications have been accessioned to date. New CRREL publications are listed in the laboratory's information bulletin and in a cumulative annual supplement. The results of many CRREL investigations are also published in professional journals.

The CRREL library maintains an extensive collection of material on cold regions science and technology. The library is open to the public and welcomes requests from other organizations for information about cold regions technical literature.

All CRREL publications can be obtained from the National Technical Information Service, Springfield, Virginia, 22161. Some are available directly from the CRREL Publications Office. For *general information about the laboratory, contact CRREL's Public Affairs Office* at the following address:

USACRREL
72 Lyme Road
Hanover, New Hampshire 03755
Telephone: 603-646-4292
(Autovon 684-4292)

CRREL welcomes requests from other organizations for assistance with cold regions problems. These requests will be forwarded to the engineer or scientist who specializes in the specific problem area.

DESCRIPTION OF CRREL TECHNICAL PUBLICATIONS

Bibliography on Cold Regions Science and Technology

The *Bibliography on Cold Regions Science and Technology* was first published in 1951 and is a continuing publication of the Cold Regions Bibliography Section of the Library of Congress. It is sponsored by and prepared for CRREL. Volumes 1-15 were issued as the *Bibliography on Snow, Ice and Permafrost*, SIPRE Report 12. Beginning with volume 16 the title was changed to *Bibliography on Snow, Ice and Frozen Ground, with Abstracts*, and with volume 23 the current title was adopted.

Nearly all of the literature cited in the *Bibliography on Cold Regions Science and Technology* has been placed on microfiche and is available from the Library of Congress or CRREL library. Those interested in purchasing a photocopy of documents cited should address their request to: The Library of Congress, Photo Duplication Service, Dept. C-177, 10 First Street S.E., Washington, D.C. 20540. A complete bibliographic citation should be given. Online search of the *Bibliography on Cold Regions Science and Technology* (File Cold) is offered by

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You may contact the CRREL library for additional information.

Current Literature—Cold Regions Science and Technology

Current Literature is also prepared for CRREL by the Cold Regions Bibliography Section of the Library of Congress. All CRREL reports and outside publications are announced as published. The 12 monthly listings are proofed, cumulated and published along with indexes each year as the *Bibliography on Cold Regions Science and Technology.*

CRREL Reports

The results of all major research efforts at CRREL are published in the *CRREL Report* series.

Special Reports

The *Special Report* series contains a wide variety of types of reports that do not fall within the *CRREL Report* category, e.g. literature reviews, data compilations, interim reports.

Monographs

The *Cold Regions Science and Engineering Monograph* series comprises comprehensive reviews of a field of scientific or technical knowledge with analysis and evaluation.

Miscellaneous Publications

This series chiefly includes papers by CRREL authors that are published outside the laboratory (e.g. journal articles, conference papers, reports published by other agencies.)

Internal Reports and Technical Notes

The *Internal Report* series contains documents that have not been published for reasons such as excessive expense, limited interest, etc. Copies are available for review in the CRREL library. *Technical Notes* are informal, preliminary, unreviewed papers that are not intended for external distribution.

AVAILABILITY OF PUBLICATIONS

Most CRREL reports are announced as published in *Government Reports Announcements,* a semi-monthly abstract journal. They are available from the National Technical Information Service (NTIS), Springfield, VA 22161. The telephone number is 703-487-4650.

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In the District of Columbia, the *NTIS Information Center and Bookstore* is in the Pennsylvania Building, Suite 620, 425 13th Street N.W. Telephone (202) 377-0365. Several hundred best selling titles are displayed for sale and for immediate delivery without Rush Handling surcharge.

The *Springfield Operations Center* has a much more limited display of research reports, but any titles may be ordered for future delivery.

Prices for most reports are $6.50 microfiche, $9.95 Xerox copy.

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ARCTIC ENVIRONMENT AND THE ARCTIC SURFACE EFFECT VEHICLE.

Sterrett, K.F., Jan. 1976, 28p., ADA-024 849, Bibliography p.25-28.

31-4161

AIR CUSHION VEHICLES, SEA ICE, TOPOGRAPHIC FEATURES, ARCTIC LANDSCAPES.

This report summarizes the advances in understanding of the Arctic which have come about since the inception of the ARPA Arctic Surface Effect Vehicle Program in 1970, primarily as the result of CRREL's participation. Major efforts to increase knowledge of sea ice, terrestrial, and coastal topographic features are described. Special emphasis is placed upon the quantitative understanding of pressure ridging. Other areas of major interest are atmospheric characteristics and ecological effects. A list of publications generated is included.

CR 76-02

PROTECTED MEMBRANE ROOFS IN COLD REGIONS.

Aamot, H.W.C., et al, Mar. 1976, 27p., ADA-025 226, 32 refs.

Schaefer, D.

31-4162

ROOFS, WATERPROOFING, INSULATION, COST ANALYSIS.

Protected membrane roofs have the prerequisites for better performance and the experience to date is encouraging. The results of performance measurements of three roofs built by the Corps of Engineers verify that the mambrane remains at nearly constant temperature, independent of the weather, and that the insulation retains its integrity despite periodic wetting. Moisture absorption is slow and appears to stabilize in time due to the self-drying nature of the roof. Heat losses are increased due to rain, and extra insulation should be added to compensate for these losses. The resistance of protected membrane roofs to fire, traffic, impact, and other adverse forces is superior. So far, the initial cost of protected membrane roofs is at a premium, primarily due to the cost of concrete pavers. The initial cost premium can be justified, however, by the reduced repair and maintenance costs as indicated to date, and by the longer life expectancy of the protected membrane. The high probability of superior performance and cost effectiveness is a compelling reason to incorporate protected membrane roofs increasingly in Government construction.

CR 76-03

SURVEY OF DESIGN CRITERIA FOR HARBORS AND CHANNELS IN COLD REGIONS—AN ANNOTATED BIBLIOGRAPHY.

Haynes, F.D., Mar. 1976, 32p., ADA-025 226.

31-4163

BIBLIOGRAPHIES, PORTS, CHANNELS (WATERWAYS), ICE LOADS, DESIGN CRITERIA.

A world-wide review of the literature applicable to the design of harbors and channels in cold regions was conducted. Forces due to ice movement present the dominant factor in the design of marine structures in cold regions. Expressions for calculating the ice force are presented. Other factors relating to design criteria such as construction materials, structure geometry, and methods of ice suppression are discussed.

CR 76-04

ISLANDS OF GROUNDED SEA ICE.

Kovacs, A., et al, Apr. 1976, 24p., ADA-025 257, 26 refs.

Gow, A.J., Dehn, W.F.

31-4164

SEA ICE, ICE ISLANDS, SPACEBORNE PHOTOGRAPHY.

Large areas of grounded sea ice have been reported by early arctic explorers and more recently by the U.S. Coast Guard. The ESSA, EPTS, NOAA and DMSP satellites now provide multispectral imagery with sufficiently high resolution to allow detailed sequential observations to be made of the movement and spatial extent of arctic sea ice. This report discusses the location, formation and decay of five large (>30 sq km) islands of grounded sea ice in the southern Chukchi Sea as observed for an extended period of time using satellite imagery. Measurements of the bathymetry around one grounded sea ice feature are presented along with observations made and photos taken from the ice surface. The potential use of these sea ice islands as research stations is also discussed.

CR 76-05

INTERPRETATION OF THE TENSILE STRENGTH OF ICE UNDER TRIAXIAL STRESSES.

Nevel, D.E., et al, Apr. 1976, 9p., ADA-027 042, 12 refs.

Haynes, F.D.

31-4165

ICE STRENGTH, TENSILE STRENGTH, THEORIES, STRESSES.

Griffith, and later Babel, have previously developed a tensile fracture criterion for a two-dimensional state of stress. This theory is extended to the compression-compression region. From this theory the angle of fracture is developed. The theory is extended conceptually to three dimensions. Triaxial test data by Haynes for snow-ice are shown in this three-dimensional fracture theory. The test data are slightly less than those predicted when the void in the snow-ice is spherical.

CR 76-06

WATER FLOW THROUGH VEINS IN ICE.

Colbeck, S.C., Apr. 1976, 5p., ADA-026 631, 8 refs.

31-4166

GLACIERS, WATER FLOW, WATER PRESSURE, POROUS MATERIALS.

Water flow through the vein structure of temperate ice is described as Darcian flow in which the pressure gradient is determined from vein size and overburden pressure. A solution method for the resulting equation is given and two special cases are considered. For steady flow the equilibrium vein size is a function of depth and, by neglecting the effects of diffusion, it is shown that flow perturbations introduced at the surface propagate downward at a constant speed. These perturbations propagate so slowly that even annual surface fluctuations of flow may be eliminated by diffusion before reaching the bottom of the glacier.

CR 76-07

CANTILEVER BEAM TESTS ON REINFORCED ICE.

Ohstrom, E.G., et al, Apr. 1976, 12p., ADA-025 380, 6 refs.

DenHartog, S.L.

31-4167

ICE STRENGTH, ICE ROADS, FLOATING ICE, REINFORCEMENT (STRUCTURES).

To determine the effectiveness of reinforcement in ice roads or other uses of a floating ice sheet a series of in-situ cantilever beam tests were run in both seawater ice and freshwater ice. Tests were run using 1-in.-diameter tree branches, 3/16-in.-diameter wire rope and 9/16-in. half-round wood dowels. The tests demonstrated clearly that properly placed reinforcement increases the bending strength of the ice and showed further that reinforcement reduces the chances of equipment loss. The question of whether to reinforce or simply grow a thicker ice sheet has not been addressed as this is more a problem of local economics.

CR 76-08

PREDICTION OF UNFROZEN WATER CONTENTS IN FROZEN SOILS FROM LIQUID DETERMINATIONS.

Tice, A.R., et al, Apr. 1976, 9p., ADA-026 632, 30 refs.

Anderson, D.M., Banin, A.

31-4168

SOIL WATER, UNFROZEN WATER CONTENT.

During the past decade a number of methods for measuring the amount of unfrozen water in partially frozen ground have emerged. Means of quickly and simply predicting unfrozen water contents in clay have become increasingly important with the growth of interest in encapsulating clay soils compacted at low water contents to serve as base courses for roads. Unfortunately the measurements require sophisticated equipment and, in most instances, specially trained operators. In an effort to simplify the task of obtaining water-ice phase composition data, methods of calculating phase composition curves from other, simpler measurements on soils have been sought. In this paper we present a method of deriving the measurement of unfrozen water contents at various temperatures from liquid limit determinations. Previous studies have indicated that phase composition curves can be well represented by a simple power equation, W sub u = alpha x theta sup beta, where W sub u is the unfrozen water content in g H20/g soil, theta is the temperature in degrees below freezing and alpha and beta are empirical constants characteristic of a given soil. When the liquid limits of a large group of soils encompassing a wide range of textures were regressed against values of alpha, the correlation was found to be remarkably good. This has permitted the development of a prediction equation of sufficient accuracy for general engineering use.

CR 76-09

SITE ACCESS FOR A SUBARCTIC RESEARCH EFFORT.

Slaughter, C.W., Apr. 1976, 13p., ADA-026 624, 9 refs.

31-4169

RESEARCH PROJECTS, REMOTE SENSING, SITE ACCESSIBILITY.

Access to study areas may be an important factor in long-term field-oriented research, particularly in regions without well-developed road and communications systems. In a wildland hydrometeorology research project in subarctic Alaska, access to and within a 40-square-mile research watershed has been developed both in accordance with a general plan prepared at project inception and in response to developing research requirements. Foot trails, trails for "off-road" low-ground-pressure tracked vehicles, helicopter transport, long-term data recorders, and radio telemetry of data have all been incorporated in an access and communications system. Cost estimates indicate that incorporation of gravel roads into the system would be economically advantageous, given adequate funding for initial road construction.

CR 76-10

DE-ICING USING LASERS.

Lane, J.W., et al, Apr. 1976, 25p., ADA-026 637, 27 refs.

Marshall, S.J.

31-4170

ICE REMOVAL, LASERS, STRUCTURES, DAMAGE.

The feasibility of employing a laser to de-ice remote surfaces was investigated. A Nd:Glass laser, wavelength 1.06 micrometers, and a Ruby laser, wavelength 6943A, were used to irradiate ice grown upon six types of substrates - asphalt, brass, concrete, aluminum, steel, and stone. It was found that a single pulse, delivered to the interface between the ice and its substrate at a power density of 100 million to 1 billion watts/cm2, produced fractures 0.1 to 2 cm in diameter for all substrates. If the initial fracture could be propagated by suitable scanning of the optical beam over the interface, the ice could be disrupted and thus removed from the substrate. The technique could also be a useful adjunct to de-icing methods that depend upon the existence of an initial crack. The process of producing the initial fracture was found to be limited by the thickness of the ice, the bubble content of the ice, and the focusing system.

CR 76-11

EFFECTS OF RADIATION PENETRATION ON SNOWMELT RUNOFF HYDROGRAPHS.

Colbeck, S.C., Apr. 1976, 9p., ADA-025 763, 10 refs.

For this report from another source see 31-4211.

31-4171

SNOW HYDROLOGY, RUNOFF, RADIATION ABSORPTION.

Water flow through the unsaturated portion of a snowpack is calculated using various assumptions about radiation penetration into the snow. The results show that for the purposes of hydrologic forecasting, it is sufficiently accurate to assume that all of the radiation absorption occurs at the surface. The error in the calculation of flow is largest for very shallow snowpacks, but this error is reduced by radiation absorption at the base of the snow and by the routing of meltwater through the saturated basal layer.

CR 76-12

HEAT TRANSFER CHARACTERISTICS OF MELTING AND REFREEZING A DRILL HOLE THROUGH AN ICE SHELF IN ANTARCTICA.

Yen, Y.-C., et al, Apr. 1976, 15p., ADA-026 365, 3 refs.

Tien, C.

31-4172

HEAT TRANSFER, BOREHOLES, ICE SHELVES, ICE MELTING, REGELATION.

The heat transfer processes associated with melting and refreezing a drill hole 500 m in depth and 0.150 m in initial radius through an ice shelf were approximately analyzed. The results were expressed in graphical form showing the time available for experimentation under the hole as a function of heating duration and heating strength. It was found that the refreezing of the drill hole had a much slower rate than the melting of the hole. (Auth.)

CR 76-13

WINTER THERMAL STRUCTURE AND ICE CONDITIONS ON LAKE CHAMPLAIN, VERMONT.

Bates, R.E., June 1976, 22p., ADA-027 146, 9 refs.

31-4173

LAKE ICE, THERMAL REGIME, ICE CONDITIONS, MEASURING INSTRUMENTS, UNITED STATES—VERMONT—LAKE CHAMPLAIN.

The thermal structure and ice conditions of Lake Champlain, a mid-latitude large lake, near Shelburne Point, Vermont, were studied during the winter of 1974-75. The lake was instrumented to a depth of 8.5 m with a string of highly calibrated thermistors, connected to a data logger on shore which *recorded water temperatures every four hours.* An ice mooring system was developed to anchor the thermistor string so that ice and water temperatures could be obtained at known levels. This temperature recording system measured vertical and horizontal variations in ice and water temperature regimes during ice formation, growth and decay. Meteorological data were measured during the winter period November 1974 through March 1975 at the site. Ice stratigraphy was determined for the ice at the site at its maximum seasonal growth for comparison with ice from St. Albans Bay (at the northern end of Lake Champlain) which had formed earlier. Correlations were determined between ice growth and accumulated degree days of freezing. The operation of a bubbler system installed near the measurement site around a service dock was observed.

CR 76-14

THERMAL POLLUTION STUDIES OF FRENCH CREEK, EIELSON AFB, ALASKA.

McFadden, T., June 1976, 5p., ADA-027 405, 7 refs.
31-4174

THERMAL POLLUTION, WATER POLLUTION, UNITED STATES—ALASKA—EIELSON AFB.

At the height of warm weather in Alaska in 1975, temperature measurements were made to determine the extent of the thermal impact on French Creek due to a condenser cooling water impact from the Eielson AFB Power plant. Water temperature measurements during a two-day period failed *to show any significant thermal impact on the water in* French Creek. It was concluded that no thermal pollution exists due to this warm water input at the volumes and conditions that presently exist.

CR 76-15

REVEGETATION IN ARCTIC AND SUBARCTIC NORTH AMERICA—A LITERATURE REVIEW.

Johnson, L.A., et al, June 1976, 32p., ADA-027 406, Bibliography p.22-28.
Van Cleve, K.
31-4175

PLANTS (BOTANY), ARCTIC LANDSCAPES, SUBARCTIC LANDSCAPES, REVEGETATION.

A literature review of revegetation and biological aspects of restoration research was completed for arctic and subarctic North America. Although there is a great deal of climatic variation in this region it is generally characterized by extreme *conditions, such as a short growing season and permafrost.* Most of the revegetation research has been undertaken in the last six years as a result of increased natural resource development. The primary goal has been erosion control, with aesthetics, minimization of thermokarst, and production of browse as other objectives. Revegetation and long-term restoration methods depend upon such variables as the site conditions, nutrient regime (especially as this is influenced by the climatic conditions in the Arctic and Subarctic), plant adaptations, and the selection of native or introduced species. Technologies which have been developed to meet these conditions primarily include seedbed preparation, use of seed mixes, and fertilization and seeding methods. Most of the research has focused on the use of agronomic grasses and legumes. These are selected on the basis of a number of factors, such as cold hardiness and growth form prior to evaluation in the laboratory and the field. The most successful species to date have been Arctared fescue and Nugget bluegrass in the Arctic, while these two as well as creeping red fescue, meadow foxtail, Frontier reed canarygrass, Durar hard fescue, slender wheatgrass, and Icelandic poa did well in the Subarctic. Similar methods have been attempted to a more limited extent with evaluation of native herbaceous and woody species which seem promising on the basis of natural succession studies. There are a number of continuing research needs for arctic and subarctic revegetation. These include fertilization strategies, development of specialized techniques (such as sprigging) for native species, and longer term studies. It is particularly important *to integrate short-term revegetation methods with long-term* restoration goals.

CR 76-16

MECHANICS OF CUTTING AND BORING. PART II: KINEMATICS OF AXIAL ROTATION MACHINES.

Mellor, M., June 1976, 45p., ADA-027 279, 11 refs.
31-4177

ROCK DRILLING, ROTARY DRILLING, AUGERS, TUNNELING (EXCAVATION), MECHANICAL PROPERTIES, EXCAVATION, CUTTING TOOLS.

This report, which is one of a series on the mechanics of cutting and boring in rock, deals with the kinematics of machines such as rotary drills, augers, tunnel boring machines, corers, and raise borers, in which the rotary cutting unit revolves about an axis that is parallel to the machine's direction of advance. *The discussion and analysis covers* the geometry and motion of various components of the cutting system, including such topics as tool trajectories, tool speeds, motions of the more complicated mechanisms, chipping depth, penetration rates, production and clearance of cuttings, tool angles, and spatial distribution of cutters. Worked examples are given to illustrate the application of various equations to practical problems.

CR 76-17

MECHANICS OF CUTTING AND BORING. PART III: KINEMATICS OF CONTINUOUS BELT MACHINES.

Mellor, M., June 1976, 24p., ADA-027 833, 2 refs.
31-4178

ROCK DRILLING, EXCAVATION, CUTTING TOOLS, CONTINUOUS BELT MACHINES.

This report, which is one of a series on the mechanics of cutting and boring in rock, deals with the kinematics of machines which utilize a continuous belt as the cutting unit (e.g. coal saws, shale saws, digger-chain trenchers). The discussion and analysis covers the geometry and motion of various components of the cutting system, including such topics as chipping depth, production and conveyance of cuttings, tool trajectories, tool speeds, tool angles, and arrangement of cutting tools on the belt. Worked examples are included to illustrate the application of various equations to practical problems.

CR 76-18

THICKNESS AND ROUGHNESS VARIATIONS OF ARCTIC MULTIYEAR SEA ICE.

Ackley, S.F., et al, June 1976, 25p., ADA-028 086, 11 refs.
Hibler, W.D., III, Kugzruk, F.K., Kovacs, A., Weeks, W.F.
31-4179

SEA ICE, ICE COVER THICKNESS, SURFACE ROUGHNESS, MODELS.

Three surface elevation and ice thickness profiles obtained *during the 1972 Arctic Ice Dynamics Joint Experiment Pilot* Study on a multiyear ice floe were analyzed to obtain relationships between the surface elevation, thickness and physical properties of the ice. It was found that for ice freeboards from 0.10 m to 1.05 m above sea level a linear relationship between the ice density and the freeboard could be postulated in a statistical relationship consistent with the observed physical properties, which indicate that as the ice freeboard increases, the ice salinity decreases and the higher freeboard or thicker ice therefore decreases in density. Using this variable density with freeboard relationship, a model was constructed to predict the ice thickness, given the ice freeboard and snow depth alone. The model was compared with two other models, one assuming constant ice density (independent of freeboard) and the other using smoothing filters for predicting the ice thickness. It was found that the variable density prediction model gave the best approximation to the observed ice thickness, with a standard error between the measured and predicted value of about 0.4 m, compared *with errors from* 50 to 100% higher *for* the other two models. The model was also compared with data on multiyear ice from two other investigations in different regions and was found to give error estimates similar to the error of the data set on which the model was based. It is therefore concluded that the model can be useful to estimate multiyear ice thicknesses from surface elevation information obtained either by ground-based techniques or by aerial methods such as laser profilometry or stereo aerial photogrammetry. The effect of the variable density on estimates of the stress induced in the ice sheet by *isostatic* imbalance loading was examined and the results are presented in an appendix. Consideration of this property led to the conclusion that stresses from sources other than isostatic imbalance must account for 75% or more of the bending stresses necessary to induce cracking in multi-year ice.

CR 76-19

WASTEWATER RENOVATION BY A PROTOTYPE SLOW INFILTRATION LAND TREATMENT SYSTEM.

Iskandar, I.K., et al, June 1976, 44p., ADA-029 744, Bibliography p.33-35.
Sletten, R.S., Leggett, D.C., Jenkins, T.F.
32-1066

WASTE TREATMENT, WATER TREATMENT, SOIL CHEMISTRY, SEEPAGE.

The feasibility of a slow-infiltration land treatment system as an alternative to advanced waste treatment of wastewater was studied using six outdoor test cells. Wastewater was applied to forage grasses by spray irrigation. Parameters studied were wastewater application rate, effect of pretreatment and soil type and seasonal effects on the treatment system. Activated sludge pretreatment of the applied wastewater did not improve the overall quality of the product water from this slow-infiltration system. *The uptake of nutrients by* forage grasses accounted for significant removal of nitrogen and phosphorus from applied wastewater during the growing season. Other renovative mechanisms, namely nitrification/dentrification of applied nitrogen and phosphorus immobilization and fixation by the soils may have accounted for further renovation of the applied effluents. The nitrogen loading rate appeared to be the critical factor in limiting the amount of wastewater that could be successfully applied to this type of land treatment system, at least over the short term. Also the renovative mechanisms for nitrogen were found to be seasonally dependent. Due to decreased nitrification and sorption of ammonium by soil components nitrogen was stored in the winter months. The sorbed ammonium underwent nitrification in the warmer months, giving rise to a high concentration of nitrate-N in spring. The higher nitrate concentrations observed in leachate after the first year of wastewater application were attributed to mineralization of native organic-N. Application of 15 cm/week of secondary effluent containing 27 mg/l total N to sandy loam soil produced percolate water containing NO3-N concentrations consistently in excess of accepted drinking water standards (10 mg NO3-N/l). Leaching phosphorus was not observed but needs further study to predict long-term effects. Winter-time application was successful in terms of operational parameters, but the renovative capacity for nitrogen was impaired. The effect on the other water quality parameters such as suspended solids, BOD, fecal coliform and organic-C was essentially complete removal. There was a negative chloride balance which was presumed to be due to plant uptake.

CR 76-20

APPARENT ANOMALY IN FREEZING OF ORDINARY WATER.

Swinzow, G.K., June 1976, 23p., ADA-039 177, 9 refs.
32-1067

ICE FORMATION, ICE CRYSTAL NUCLEI, SUPERCOOLED WATER, IMPURITIES, TEMPERATURE VARIATIONS, LABORATORY TECHNIQUES.

Under ordinary conditions the freezing of water begins with supercooling and ice nucleation, and proceeds at 0C at the ice/water interface until ice formation stops. The presence of solutes, high pressure, or dispersal in fine pores causes the water to freeze at temperatures below 0C (the so-called freezing point depression). Whenever freezing begins, it proceeds at a constant temperature, or at a temperature which becomes progressively lower. A temperature rise during ice formation is considered here to be an anomaly. Under all equal circumstances, the conditions under which an anomalous freezing temperature is observable appear to be very special. This report describes two different experiments displaying the anomalous rise of temperature after nucleation and during ice formation. In one case the water was dispersed in the fine pores of fine powders; in the other case pure water was frozen in a transparent insulated cell. Photographic observations were made; relations of ice surface to water volume were measured.

CR 76-21

COMPRESSIBILITY CHARACTERISTICS OF COMPACTED SNOW.

Abele, G., et al, June 1976, 47p., ADA-028 622, 5 refs.
Gow, A.J.
32-1068

SNOW TEMPERATURE, SNOW DENSITY, SNOW DEFORMATION, STRESSES, PHASE TRANSFORMATIONS, RECRYSTALLIZATION.

The effects of snow temperature and initial density on the stress vs density and stress vs deformation relationships were investigated for shallow compacted snow in the density range of 0.28 to 0.76 g/cu cm, for a stress range of 0.5 to 72 bars and a temperature range of -1 to -34C at a deformation rate of 40 cm/sec. A decrease in temperature increases the resistance to stress, the effect increasing with applied stress. For any stress, an increase in the initial density results in an increase in the resulting density, the effect decreasing with an increase in stress. The approximate yield envelopes, which define the stress required to initiate any deformation of snow of a particular density and temperature, *were determined. Rapid compaction of snow results* in extensive recrystallization, significantly different from that of naturally compacted snow. At a stress of 72 bars, transformation to ice occurs only at temperatures above -10C.

CR 76-22

EVALUATION OF MESL MEMBRANE—PUNCTURE, STIFFNESS, TEMPERATURE, SOLVENTS.

Sayward, J.M., June 1976, 60p., ADA-027 834, 30 refs.
32-1069

SOIL STRUCTURE, SOIL STRENGTH, PROTECTIVE COATINGS, FROST PROTECTION, CELLULAR PLASTICS.

Several membrane materials used or considered for MESL (membrane-enveloped soil layer) utilization of poor soils in road construction have been tested for cold effect on puncture and stiffness. PE (polyethylene) film was also tested for solvent soak effects. A simple blunt needle apparatus was devised for puncture testing. For plastic films (mainly PE), both puncture resistance and stiffness increase at low temperature. For non-woven, spunbonded fabrics these properties are little affected by cold. For both non-wovens and PE film, puncture and bending strengths increase linearly with weight or thickness. The slope is steeper for the non-wovens, which generally are stronger on a per unit weight basis. PE film soaked in a hydrocarbon solvent swelled approximately 17% and lost about 30-40% of its puncture strength. These effects are apparently reversible upon drying. Consideration has been given to sealing and patching requirements and to the drying of sealant liquids when adhering film to film. Also considered have been possible slippage related to the reported low angle of friction of plastic films in soil and the possibility of lamination for improved membrane properties.

CR 76-23

STUDY OF PILES INSTALLED IN POLAR SNOW.

Kovacs, A., July 1976, 132p., ADA-029 191, 18 refs.
32-1070

PILE DRIVING, SNOW BEARING STRENGTH, SNOW MECHANICS, GREENLAND.

This report describes the study of piles tested in polar snow at Camp Century, Greenland. More than 20 piles of various lengths and sizes were driven, including timber, closed-end and open-end steel pipe piles, and I- and H-piles. The H-piles were instrumented with strain gages. In addition to the driven piles, two purely end-bearing piles were installed in augered holes and five piles were frozen in place using a snow-water slurry. Driving records were obtained and are discussed. Analysis of the driving response of various piles revealed that the Hiley formula, and presumably other similar pile driving formulas, cannot be used to predict the ultimate supporting capacity of piles driven in snow. Factors such as pile inertia, rigidity, size, and tip resistance are discussed in relation to their apparent influence upon pile penetration. Pile load test procedures are described and test results are discussed. It was found that closed-end pipe piles are decidedly inferior to open-end pipe piles in their load-carrying capability and their ultimate supporting capacity. Although pile settlement was found to be dependent upon such variables as pile load, time, pile shape, and snow temperature, precise effects of these variables were not determined. Nevertheless, the capability of open-end piles to carry quite heavy loads was demonstrated and a procedure is presented for testing these piles in snow. Strain gage instrumentation is described and its performance discussed. Both dynamic and static strain data were obtained and analyzed to reveal the strain distribution within a pile during driving and static loading. Excavations revealed the configuration of the densified snow displaced along the sides and beneath the tips of a number of driven piles. Inspection of this displacement gave insight into the carrying response of each pile type.

CR 76-24

VANADIUM AND OTHER ELEMENTS IN GREENLAND ICE CORES.

Herron, M.M., et al, July 1976, 4p., ADA-029 356, 16 refs.

Langway, C.C., Jr., Weiss, H.V., Hurley, J.P., Kerr, R., Cragin, J.H.

32-1071

SNOW COMPOSITION, CHEMICAL ANALYSIS, ICE CORES, ICE COMPOSITION, IMPURITIES, GREENLAND.

Chemical analysis of surface snows and deeper ice core samples from Milcent, Greenland, indicates a marine origin for Na and Cl and a terrestrial origin for Al, Mn and V. Pre-1900 enrichment factors, based on average crustal composition, are high for Zn and Hg and appear to be related to their volatility. A comparison of pre-1900 and 1971-1973 concentrations of V and Hg shows no decided increase from industrial production; however, the abundance of Zn (relative to Al) increased three-fold during this time period. The chemical composition of ancient ice is extremely useful in interpreting modern aerosols.

CR 76-25

BASELINE DATA ON THE OCEANOGRAPHY OF COOK INLET, ALASKA.

Gatto, L.W., July 1976, 84p., ADA-029 358, Bibliography p.78-81.

32-1072

OCEAN CURRENTS, TIDAL CURRENTS, WATER CHEMISTRY, SEDIMENT TRANSPORT, TURBULENT FLOW.

The primary objective of this investigation was to compile baseline information pertaining to the ocean circulation, especially the extent and patterns of tidal currents and tidal flushing, in Cook Inlet, Alaska, utilizing aircraft and satellite imagery with corroborative ground truth data. LANDSAT-1 and NOAA-2 and -3 imagery provided repetitive, synoptic views of surface currents, water mass migration and sediment distribution during different seasons and tides. Color, color infrared and thermal infrared imagery acquired on 22 July 1972 with the NASA NP-3A aircraft were used to analyze currents, mixing patterns and sediment dispersion in selected areas. Temperature, salinity and suspended sediment concentration data and hand-held photography were utilized as ground truth information in the interpretation of the aircraft and satellite imagery. Coriolis effect, semidiurnal tides and the Alaska current govern the estuary circulation. Clear, oceanic water enters the inlet on the southeast during flood tide, progresses northward along the east shore with minor lateral mixing, and remains a distinct water mass to the latitude of Kasilof-Ninilchik. South of the forelands, mixing with turbid inlet water becomes extensive. Turbid water moves south primarily along the north shore during ebb tide and a shear zone between the two water masses forms in mid-inlet south of Kalgin Island. Currents adjacent to and north of the forelands are complicated by tidal action, coastal configuration and bottom effects. Turbulence is greatest throughout the water column along the south shore and stratification is more pronounced in Kamishak and Kachemak Bays, especially when fresh water runoff is high. Most of the sediment discharged into the inlet is deposited on the extensive tidal flats or removed by tidal currents along the west side during ebb flow. Bottom scouring is evident along the east shore south of Pt. Possession.

CR 76-26

DEBRIS OF THE CHENA RIVER.

McFadden, T., et al, July 1976, 14p., ADA-029 357, 5 refs.

Stallion, M.

32-1073

RIVERS, LOGJAMS, UNITED STATES—ALASKA—CHENA RIVER.

Debris over a 44-mile stretch of the Chena River was studied. The study area extended from the first bridge on the Chena Hot Springs Road to the Chena River Flood Control damsite. The purpose of the study was to assess the potential danger to the Chena River Flood Control Dam outlet structure. Debris was catalogued, log jams were measured, and sources of debris were studied. The average size of logs was determined, as well as the number of logs present on the river. The authors concluded that a serious debris problem existed and would remain serious for the foreseeable future. Recommendations for debris handling were made.

CR 76-27

ENERGY BALANCE AND RUNOFF FROM A SUBARCTIC SNOWPACK.

Price, A.G., et al, August 1976, 29p., ADA-030 096, Bibliography p.28-29.

Dunne, T., Colbeck, S.C.

32-1074

SNOW HYDROLOGY, SNOWMELT, RUNOFF, MOISTURE TRANSFER, TUNDRA VEGETATION, FOREST LAND.

In Part I a physically based model was used to predict daily snowmelt on 2,000 sq m plots in the Subarctic. The plots had a range of aspects and inclinations in boreal forest and on the tundra. The energy balance, computed for each of the plots, was compensated for differences in radiative and turbulent energy fluxes caused by varied slope geometry and vegetative cover. The turbulent energy fluxes were also corrected for the effects of the stable stratification of the air over the snow surface. The predictions of the model were compared with daily melts derived from runoff measured on the snowmelt plots. The results show that the method is a good predictor of daily amounts of snowmelt, although some uncertainties are introduced by changes in the snow surface during the melt period. In Part II, a physically based model of the movement of water through snowpacks was used to calculate hydrographs generated by diurnal waves of snowmelt on the tundra and in the boreal forest of subarctic Labrador. The model was tested against measured hydrographs from hillside plots that sampled a range of aspect, gradient, length, vegetative cover, and snow depth and density. The model yielded good results, particularly in the prediction of peak runoff rates, though there was a slight overestimate of the lag time. A comparison of predictions against field measurements indicated that, given the ranges over which each of the controls is likely to vary, the two most critical factors controlling the hydrograph are the snow depth and the melt rate, which must be predicted precisely for short intervals of time. Permeability of the snowpack is another important control, but it can be estimated closely from published values.

CR 76-28

ANALYSIS OF EXPLOSIVELY GENERATED GROUND MOTIONS USING FOURIER TECHNIQUES.

Blouin, S.E., et al, August 1976, 86p., ADA-030 060, 18 refs.

Wolfe, S.H.

32-1075

SEISMIC SURVEYS, WAVE PROPAGATION, VIBRATION, EXPLOSION EFFECTS, NUCLEAR EXPLOSIONS, EARTH MOVEMENT, FOURIER TRANSFORMS OF SELECTED GROUND-MOTION TIME HISTORIES FROM FIVE UNDERGROUND HIGH-EXPLOSIVE AND NUCLEAR DETONATIONS ARE USED TO DEFINE THE TRANSMISSION PROPERTIES (TRANSFER FUNCTIONS) OF THREE ROCK TYPES.

Absorption, a measure of a rock's energy dissipating characteristics, is expressed for each of the tests as a function of the frequency of transmission. Dispersion results from a variation in transmission velocity with frequency and is described for each test by a phase velocity spectrum. The transmission properties from one of the sites are used to predict a ground-motion time history at that site from another nuclear event. The potential use of Fourier techniques to make ground-motion predictions and to measure in-situ material properties is discussed.

CR 76-29

FAILURE OF AN ICE BRIDGE.

DenHartog, S.L., et al, August 1976, 13p., ADA-030 413, 2 refs.

McFadden, T., Crook, L.

32-1077

BRIDGES, ICE COVER STRENGTH, ICE BEARING CAPACITY.

In order to verify current theoretical equations on ice bearing capacity, a heavily loaded truck was used to make successive passes over two ice bridges. Breakthrough occurred on one bridge with a vehicle weight of 53,630 lb (24,327 kg). The ice thickness was 17.5 in. (44.5 cm). This one test was in good agreement with the theoretical equations.

CR 76-30

REMOTE SENSING OF LAND USE AND WATER QUALITY RELATIONSHIPS—WISCONSIN SHORE, LAKE MICHIGAN.

Haugen, R.K., et al, Aug. 1976, 47p., ADA-030 746, Bibliography p.42-43.

McKim, H.L., Marlar, T.L.

32-1078

REMOTE SENSING, AERIAL SURVEYS, SPACEBORNE PHOTOGRAPHY, INFRARED PHOTOGRAPHY, LAND DEVELOPMENT, UNITED STATES—WISCONSIN.

The f[illegible] of this investigation was to assess the utility of remote sensing techniques in the study of land use-water quality relationships in an east central Wisconsin test area. The following types of aerial imagery were evaluated for this purpose: high altitude (60,000 ft) color, color infrared, multispectral black and white, and thermal; low altitude (less than 5,000 ft) color infrared, multispectral black and white, thermal, and passive microwave. A non-imaging hand-held four-band radiometer was evaluated for utility in providing data on suspended sediment concentrations. Land use analysis includes the development of mapping and quantification methods to obtain baseline data for comparison to water quality variables. Suspended sediment loads in streams, determined from water samples, were related to land use differences and soil types in three major watersheds. A multiple correlation coefficient R of 0.85 was obtained for the relationship between the 0.6-0.7 micron incident and reflected radiation data from the hand-held radiometer and concurrent ground measurements of suspended solids in streams. Applications of the methods and baseline data developed in this investigation include mapping and quantification of land use, input to watershed runoff models, estimation of effects of land use changes on stream sedimentation, and remote sensing of suspended sediment content of streams. High altitude color infrared imagery was found to be the most acceptable remote sensing technique for the mapping and measurement of land use types.

CR 76-31

ANALYSIS OF POTENTIAL ICE JAM SITES ON THE CONNECTICUT RIVER AT WINDSOR, VERMONT.

Calkins, D.J., et al, Sep. 1976, 31p., ADA-031 57[illegible] 11 refs.

Hutton, M.S., Marlar, T.L.

32-1079

RIVER ICE, ICE JAMS, ICE MECHANICS, WATER FLOW.

Sections in the Connecticut River where ice jam potential is high were identified through the use of low-altitude black and white photographs taken during low-flow, ice-free conditions. The hydraulics and mechanics of ice jam initiation were investigated in the river reach where these sections were identified. Certain areas were found in the river that had a high susceptibility to ice clogging, but this high potential decreased with increasing discharge because of the improved surface conveyance of the ice through the reach. The stability of ice floes was established along the channel, but the floes generally became unstable as the flow increased. This was calculated by using a Froude number criterion. Grounding locations for ice became evident when the critical Froude number was zero for a given thickness and water depth. No single factor was determined to be responsible for initiating the ice jams in the Connecticut River at Windsor. Apparently there existed a multitude of interacting conditions: surface constrictions, possible high backwater conditions from the Brattleboro Dam, a solid ice cover in the backwater of the Brattleboro Dam that prevented ice transport from the Windsor area, deep pools followed by shallow depth sections upstream of bridge piers, a greater ice thickness accumulation of fragmented floes than would result if a uniform cover could be established in the same reach, and the diurnal fluctuation of river stage caused by the release of water at Wilder Dam.

CR 76-32

GROUNDED ICE IN THE FAST ICE ZONE ALONG THE BEAUFORT SEA COAST OF ALASKA.

Kovacs, A., Sep. 1976, 21p., ADA-031 352, 13 refs.

32-1080

SEA ICE, FAST ICE, ICE PHYSICS, PRESSURE RIDGES.

Four large grounded multi-year shear ridge formations were found in the grounded ice subzone of the fast ice zone near the Harrison Bay/Prudhoe Bay area of Alaska. A 166m-long cross section of one of these formations was obtained by leveling and sonar measurements. These measurements revealed that the maximum ridge height was 12.6 m and that the formation was grounded in 17-18 m of water. The salinity, temperature, brine volume and density of the ice were determined on samples obtained by coring. The physical characteristics of the formations as observed in satellite, SLAR and aerial imagery indicate that these formations have not moved between the time of their formation in the fall of 1974 and August of 1976. Evidence of significant aeolian debris discoloring the ice is discussed.

CR 76-33
DETECTING STRUCTURAL HEAT LOSSES WITH MOBILE INFRARED THERMOGRAPHY. PART 4: ESTIMATING QUANTITATIVE HEAT LOSS AT DARTMOUTH COLLEGE, HANOVER, NEW HAMPSHIRE.
Munis, R.H., et al, Sep. 1976, 9p., ADA-031 803, 3 refs. For Parts I, II, and III of this study see 29-2349, 30-895, and 30-1807 respectively.
Marshall, S.J., Bush, M.A.
32-1081
BUILDINGS, HEAT LOSS, INFRARED EQUIPMENT.

During the winter of 1973-74 a mobile infrared thermography system was used to survey campus buildings at Dartmouth College, Hanover, New Hampshire. This report provides both qualitative and quantitative data regarding heat flow through a small area of a wall of one brick dormitory building before and after installation of aluminum reflectors between radiators and the wall. These data were used to estimate annual cost savings for 22 buildings of similar construction having aluminum reflectors installed behind 1,100 radiators. The data were then compared with the actual savings which were calculated from condensate meter data. The discrepancy between estimated and actual annual cost savings is explained in detail along with all assumptions required for these calculations.

CR 76-34
SOME CHARACTERISTICS OF GROUNDED FLOEBERGS NEAR PRUDHOE BAY, ALASKA.
Kovacs, A., et al, Sep. 1976, 10p., ADA-031 844, 11 refs. For another version of this report see 32-1082.
Gow, A.J.
32-1083
SEA ICE, ICE BOTTOM SURFACE, SOUNDING, ICE STRUCTURE, ACOUSTIC MEASURING INSTRUMENTS, PRESSURE RIDGES.

Some physical characteristics of two grounded floebergs near Prudhoe Bay, Alaska, are described. Cross-sectional profiles of the sails and keels of both floebergs were obtained. Additional studies included investigations of the internal structure of the floebergs, surveys of the sea floor for evidence of scoring induced during grounding of the floebergs, and a brief examination of the organic and sedimentary debris found entrained within the floebergs.

CR 76-35
RHEOLOGICAL IMPLICATIONS OF THE INTERNAL STRUCTURE AND CRYSTAL FABRICS OF THE WEST ANTARCTIC ICE SHEET AS REVEALED BY DEEP CORE DRILLING AT BYRD STATION.
Gow, A.J., et al, Sep. 1976, 25p., ADA-031 745, Bibliography p.22-25.
Williamson, T.
32-1097
ICE SHEETS, DRILL CORE ANALYSIS, ICE MECHANICS, ICE STRUCTURE, ANISOTROPY, ANTARCTICA—BYRD STATION.

Crystalline textures and fabrics of ice cores from the 2,164-m-thick ice sheet at Byrd Station, Antarctica, reveal the existence of an anisotropic ice sheet. A gradual but persistent increase in the c-axis preferred orientation of the ice crystals was observed between the surface and 1,200 m. This progressive growth of an oriented crystal fabric is accompanied by a 20-fold increase in crystal size between 56 and 600 m, followed by virtually no change in crystal size between 600 and 1,200 m. A broad vertical clustering of c-axes develops by 1,200 m. Between 1,200 and 1,300 m the structure transforms into a fine-grained mosaic of crystals with their basal glide planes now oriented substantially within the horizontal. This highly oriented fine-grained structure, which persists to 1,800 m, is compatible only with a strong horizontal shear deformation in this part of the ice sheet. Rapid transformation from single- to multiple-maximum fabrics occurs below 1,800 m. This transformation, accompanied by the growth of very large crystals, is attributed to the overriding effect of relatively high temperatures in the bottom layers of old ice at Byrd Station rather than to a significant decrease in stress. The zone of single-maximum fabrics between 1,200 and 1,800 m also contains numerous layers of volcanic dust. Fabrics of the very fine-grained ice associated with these dust bands indicate the bands are actively associated with shearing in the ice sheet. Some slipping of ice along the bedrock seems likely at Byrd Station, since the basal ice is at the pressure melting point and liquid water is known to exist at the ice/rock interface. The textures and fabrics of the ice indicate that plastic deformation (intracrystalline glide) in the zone of strong single-maximum fabrics, and movement of ice along discrete shear planes situated well above bedrock, are also major contributors to the flow of the ice sheet. Any extensive shearing at depth could seriously distort stratigraphic records contained in the ice cores, such as climatic history inferred from stable isotope analysis. Also, the common practice of using simplified flow models to approximate the depth-age relationships of deep ice sheet cores may need to be revised in light of the deformational features and fabrics observed in the Byrd Station ice cores.

CR 76-36
ROCK, FROZEN SOIL AND ICE BREAKAGE BY HIGH-FREQUENCY ELECTROMAGNETIC RADIATION. A REVIEW.
Hoekstra, P., Oct. 1976, 17p., ADA-039 178, 17 refs.
32-1098
ROCK EXCAVATION, FROZEN GROUND STRENGTH, EXCAVATION, DIELECTRIC PROPERTIES, ELECTROMAGNETIC PROPERTIES, MATHEMATICAL MODELS.

In the past decade, various workers have investigated the use of high-frequency electromagnetic radiation for breaking and excavating rock and frozen ground. This report reviews the high-frequency dielectric properties of these materials, the physics of heating, and the existing literature on these subjects. The high-frequency dielectric properties of rocks and soils, and the absorption of energy by these materials, are mainly determined by their liquid water contents. Computer modeling was used to calculate absorption energy as a function of distance behind irradiated faces of earth materials. The resulting computations showed that most enery is absorbed in the first few centimeters of frozen ground and weak soils. However, in hard rocks of low water content, electromagnetic waves penetrate more deeply, and significant amounts of energy are also absorbed tens of centimeters behind the irradiated faces. Test results showed that electromagnetic rock breakage is feasible only for excavations in hard rock; test results from the use of electromagnetic radiation for excavating tunnels in weak rocks and frozen ground are not promising.

CR 76-37
AIRBORNE RESISTIVITY AND MAGNETOMETER SURVEY IN NORTHERN MAINE FOR OBTAINING INFORMATION ON BEDROCK GEOLOGY.
Sellmann, P.V., et al, Oct. 1976, 19p., ADA-032 733, 21 refs.
Arcone, S.A., Delaney, A.J.
32-1099
MAGNETIC MEASUREMENT, ELECTRICAL RESISTIVITY, GEOPHYSICAL SURVEYS, GEOLOGY, UNITED STATES—MAINE.

Geophysical studies were conducted during September and October of 1975 in northern Maine to locate rock types suitable for construction purposes for the proposed Dickey-Lincoln School Dam Project. Simultaneous airborne magnetometer and VLF electrical resistivity and of total magnetic intensity above the earth's background magnetic field. During the same time period, ground and multi-elevation surveys *were performed over a special test sector of known geology.* The ground and airborne study in the test sector aided in interpretation of the data by revealing a strong correlation between igneous geology, resistivity, and magnetic intensity. Lack of a similar correlation between resistivity and magnetic data in the remainder of the survey area suggested an absence of additional areas of igneous rocks. The multi-elevation survey of the test area indicated that changes in flight altitude, necessitated by the topographic relief encountered, would not seriously affect the regional resistivity patterns. Although there was no strong evidence of igneous rocks outside the test sector, suitable rock types may exist within the Dss geologic unit (cyclically bedded gray slate and sandstone) in the central part of the main survey area, where most of the high resistivity contours occur.

CR 76-38
WATER ABSORPTION OF INSULATION IN PROTECTED MEMBRANE ROOFING SYSTEMS.
Schaefer, D., Oct. *1976*, 15p., ADA-032 089, 12 *refs.*
32-1100
INSULATION, PROTECTIVE COATINGS, WATERPROOFING, ABSORPTION, ROOFS.

Current methods for evaluation of the moisture absorption of plastic insulations (ASTM-C-272-53 and ASTM-C-355-64) due to vapor pressure gradients or immersion rely on short time periods to predict long term performance. This procedure may not provide accurate information on performance since in practice insulations may absorb more moisture than these tests indicate. A series of tests was conducted on extruded polystyrene roof insulation that had been in place, exposed to environmental moisture and pressure gradients, for a maximum of 36 months. Results indicate that moisture absorption of 1.5% by volume can be expected in the field.

CR 76-39
EFFECTS OF WASTEWATER APPLICATION ON THE GROWTH AND CHEMICAL COMPOSITION OF FORAGES.
Palazzo, A.J., Oct. 1976, 8p., ADA-032 774, 9 refs.
32-1101
WASTES, WATER, SOIL CHEMISTRY, WATER CHEMISTRY, PLANTS (BOTANY), GRASSES.

The contribution of a forage mixture in the renovation of wastewater by a prototype slow infiltration land treatment system was studied from June 1974 to June 1975. The forage was grown in six outdoor cells, three containing a Windsor sandy loam soil and three a Carlton silt loam. Three cells received primary and three received secondary wastewater at various application rates. Crop yields, soils and tissue analyses, plant removal efficiency and total uptake of applied nutrients were related to the rate of wastewater applied. Dry matter production, plant heavy metal concentrations, and plant removal of nitrogen and phosphorus all increased as the rate of applied wastewater increased from 5 to 15 cm/week. Total dry matter production ranged from 9.63 to 12.99 metric tons/ha, and total uptake of nitrogen and phosphorus ranged from 309 to 453 kg/ha and from 32 to 42 kg/ha, respectively. An increase in wastewater application rates suppressed nitrogen and phosphorus removal efficiency by plants. Forages receiving 5 cm/wk of wastewater removed 74% and 83% of the N applied during the growing season, in contrast to the 44% removed by those treated with 15 cm/wk of wastewater. Forages grown on the Charlton soils produced a greater amount of dry matter and removed more N and less heavy metals than those grown on the Windsor soils. Soil analyses in spring 1975 showed reductions in soil pH and in the total amounts of exchangeable cations, as compared to analyses *performed in spring 1974. Soils receiving the greatest* application rate of wastewater showed the greatest reduction. Wastewater application during 1974 increased the amount of soluble soil P. Higher amounts of soil-extractable P were also noted at the highest wastewater application rate.

CR 76-40
PHOTOMACROGRAPHY OF ARTIFACTS IN TRANSPARENT MATERIALS.
Marshall, S.J., Nov. 1976, 31p., ADA-033 670, 31 refs.
32-1102
ICE, IMPURITIES, PHOTOMACROGRAPHS.

Several original methods were developed to photograph artifacts in transparent materials such as ice. The artifacts, occurring in the surface, bulk, and interface, were generally 0.01 mm to 70 mm in size. Sample preparation, illumination, focusing and other technical problems are discussed in detail. Several *sample photographs are included.*

CR 76-41
GEODETIC POSITIONS OF BOREHOLE SITES OF THE GREENLAND ICE SHEET PROGRAM.
Mock, S.J., Nov. 1976, 7p., ADA-033 840, 9 refs.
32-1103
GEODETIC SURVEYS, BOREHOLES, ICE SHEETS, ICE CREEP, GREENLAND.

Eight Geoceiver stations were established and suitably marked along or near the crestline of the Greenland ice sheet during GISP field operations from 1971 to 1975. At one of these stations, DYE-3, repeated Geoceiver positions indicate an ice velocity of 12.7 m/yr on an azimuth of approximately 60 deg. Data from the International Greenland Glaciological Expedition (EGIG) surveys show that ice flow in the vicinity of Crete is radiating outward from a dome to the south. Two independent calculations of the state of equilibri*um at Crete indicate ice sheet thinning rates of 0.25 to* 0.37 m/yr, while direct measurement of elevation change by EGIG indicates an ice sheet thickening rate of of approx 0.06 m/yr. Resolution of these differences must await further geophysical work and deep drilling in the ice sheet.

CR 76-42
ARCHING OF MODEL ICE FLOES: EFFECT OF MIXTURE VARIATION ON TWO BLOCK SIZES.
Calkins, D.J., et al, Nov. 1976, 11p., ADA-033 841, 5 refs.
Ashton, G.D.
32-1104
EXPERIMENTAL DATA, FLOATING ICE, ICE BOOMS.

A study of arching of mixed, square fragmented ice floes at an opening in an ice boom is documented, using results from a model study in which two sizes of plastic blocks represented real ice. A power function, relating the upstream ice concentration to the ratio of a characteristic block dimension to the gap opening, is found adequate to distinguish between arching and nonarching events for block mixtures of two component sizes. It is demonstrated that when the respective total areas of the two block components are nearly equal, a minimum ice concentration initiates an arch across the opening. As the mixture of two sizes of blocks approaches a *uniform (one-sized) mixture*, a *higher concentration* of ice is needed to initiate the arch. When the ratio of the block dimension to the gap opening is equal to or less than 0.10, arching of the fragmented ice is not possible, even when the upstream ice discharge exceeds the maximum discharge of ice through a gap opening. The distribution of fragmented ice areas is an important parameter in establishing the minimum size of opening at which an ice boom will retain its arching capability.

CR 76-43
SUPPRESSION OF ICE FOG FROM COOLING PONDS.
McFadden, T., Nov. 1976, 78p., ADA-035 322, Bibliography p.71-75.
32-1105
ICE FOG, FOG FORMATION, FOG DISPERSAL, PONDS, ICE COVER EFFECT, PROTECTIVE COATINGS.

Ice fog generated at the Eielson AFB power plant cooling pond contributes heavily to the total ice fog problem on the base. Several methods for ice fog suppression were studied and two techniques were tested experimentally. Experiments were also conducted to determine the magnitude of the various modes of heat transfer within the pond's microclimate. Values of evaporative and radiative heat loss during ice fog are presented. Ice cover is shown to be an effective ice fog suppression technique. Monomolecular films are also shown to be effective and offer some unique advantages, such as ease of application and low overall cost. The heat normally lost to evaporation must be dissipated by other means during suppression. With the ice cover technique this is accomplished by melting the ice cover. During suppression with monomolecular films, the heat must be dissipated by increasing radiative and convective losses. The simplicity of application of monomolecular films, along with their lower cost, combine to make this technique attractive; however, the lower pond temperatures and increased suppression effectiveness weigh heavily in favor of the ice cover technique.

CR 76-44

THERMODYNAMIC DEFORMATION OF WET SNOW.

Colbeck, S.C., Nov. 1976, 9p., ADA-033 830, 10 refs.

32-1106

WET SNOW, SNOW DEFORMATION, THERMODYNAMIC PROPERTIES.

The deformation of wet snow is explained in terms of the thermodynamics of the three phases of water. When deformation by particle rearrangement is fully developed, deformation can occur most rapidly by melting at the particle contacts. The rate of deformation is highly sensitive to the liquid water content, ionic impurity content, particle contact area, and stress level. A model of the hydrostatic deformation of wet snow is constructed, and examples of the deformation of wet snow are given for a variety of conditions. These results are in agreement with existing experimental evidence. The model accurately simulates the transient nature of the deformation and the effect of water content on the quasi-stable density of wet snow subjected to a constant stress.

CR 76-45

AIR CUSHION VEHICLE GROUND CONTACT DIRECTIONAL CONTROL DEVICES.

Abele, G., et al, Dec. 1976, 15p., ADA-034 825, 3 refs.

Liston, R.A.

32-1107

AIR CUSHION VEHICLES, YAW.

The maneuverability of air cushion vehicles can become a serious operational problem when the vehicle's travel route is restricted by obstacles, slopes or cross-wind conditions, or when close-quarter turns are required. While improvement and perfection of aerodynamic methods may be a more desirable approach, there is a practical limit to these methods, and the use of ground contact devices requires considerations for providing more positive directional control. Wheels deserve special attention, and therefore are analyzed in more detail because of their obvious application on a variety of land terrains. Brake rods and harrows are more suitable on water, ice and snow. The saucer-shaped ground contact device would cause the least ecological impact on fragile organic terrains such as tundra. Relative directional stability is evaluated in terms of the total yawing moments produced by wheel arrangements (single, dual, tandem), location on the vehicle, and operational modes (free-rolling, braked, or a combination of the two). The available moments are plotted against the yaw angle of the vehicle to determine the most effective operational mode with a particular wheel arrangement for any yaw condition. The analysis is limited to retractable devices which act as moment producing brakes or rollers and do not serve as either propulsion or load support aids. Controlled ground contact with skirt sections having special wearing surfaces may provide a suitable control method and would require the least significant change to the basic design of the vehicle or its components. The concept involves the use of an air flow control mechanism for deflating specific skirt sections, thus causing skirt-ground contact at selected areas of the peripheral skirt.

CR 76-46

TOPOLOGICAL PROPERTIES OF SOME TRELLIS PATTERN CHANNEL NETWORKS.

Mock, S.J., Dec. 1976, 54p., ADA-034 824, 27 refs.

32-1108

CHANNELS (WATERWAYS), TOPOGRAPHIC FEATURES, DRAINAGE, CLASSIFICATIONS.

The topological properties of 10 stream networks having moderate to well developed trellis drainage patterns have been compared with those expected in a topologically random population. Magnitude 4 subnetworks show a systematic departure from expectation which can be related to geological controls. A link type classification system was developed and a series of equations describing the probability of occurrence of link types in topologically random populations derived. Analysis of the link structure in the channel networks showed small but persistent deviations from expectation in the well developed trellis pattern streams. The general conclusion is that the topologically random model is a very useful standard with which to compare real channel networks.

CR 76-47

DEVELOPMENT OF LARGE ICE SAWS.

Garfield, D.E., et al, Dec. 1976, 14p., ADA-034 899, 6 refs.

Hanamoto, B., Mellor, M.

32-1109

ICE CUTTING, SAWS.

This report describes two mechanical ice-cutting systems for the removal of ice collars at the high pool level on the Poe Lock of the St. Mary's Falls Canal at Sault Ste. Marie, Michigan. One system was a narrow-kerf (3 1/4 in. wide) coal-cutting chain saw mounted on a bar, driven by a 65-hp wheeled soil trencher which cut a 0.56-in.-wide kerf. The lumber-cutting saw's bar was too flexible and the desired cutting traverse speed was not met. The coal-cutting saw cut 6-ft-deep ice collars at traverse speeds of up to 10 ft/min and is acceptable. With a few modifications, the coal-cutting saw would be operational.

CR 76-48

RAPID INFILTRATION OF PRIMARY SEWAGE EFFLUENT AT FORT DEVENS, MASSACHUSETTS.

Satterwhite, M.B., et al, Dec. 1976, 34p., ADA-035 730, 26 refs.

Stewart, G.L., Condike, B.J., Vlach, E.

32-1110

GROUND WATER, WATER TREATMENT, WATER CHEMISTRY, SEWAGE TREATMENT.

Rapid infiltration has provided final treatment to unchlorinated Imhoff tank effluent at Fort Devens, Massachusetts, since 1942. Wastewater flow has varied seasonally; however, most flows to the 22 treatment beds at the installation in 1973 were 2,676 to 9,541 cu m/day (1.3 million gallons per day). In an operation cycle of simultaneous inundation of three 0.31-hectare treatment beds for 2 days, followed by a 14-day recovery period, effluent application has been about 27.1 m/yr. Chemical analyses of soil samples obtained from the upper 3.05 m of the treatment beds showed that levels of organic matter ranged from substantially to only slightly higher than those of background samples. The quality of the primary effluent applied to the treatment beds and the groundwater in 14 observation wells was determined by comprehensive analysis of the samples at biweekly intervals. Groundwater quality in wells located 60 to 100 m from the application area showed that the primary effluent after flowing through the sand and gravel formation, had been substantially renovated.

CR 76-49

TREATMENT OF PRIMARY SEWAGE EFFLUENT BY RAPID INFILTRATION.

Satterwhite, M.B., et al, Dec. 1976, 15p., ADA-035 390, 22 refs.

Condike, B.J., Stewart, G.L.

32-1111

SEWAGE TREATMENT, WATER TREATMENT, CHEMICAL ANALYSIS, SEEPAGE.

Treatment of unchlorinated primary sewage effluent by using rapid infiltration basins resulted in a high degree of wastewater renovation in a humid, cool northern climate. Inundating 9 treatment basins for 7 days followed by 14 days of rest, from 4 January to 21 June 1974, resulted in effluent additions totaling about 27 m. Analysis of the groundwater from the treatment site and from the peripheral area showed that total coliform bacteria, 5-day biochemical oxygen demand, and chemical oxygen demand were essentially removed, while phosphorus concentrations were only one-third of the applied effluent concentrations. Total nitrogen additions to the treatment basins during the 7-day inundation period were about 54% greater than the nitrogen additions in the 1973 investigations. Even so, groundwater nitrogen concentrations were closely comparable to those observed in the 1973 study. Efforts to increase nitrogen removal through longer inundation periods resulted in a gradual decrease in the infiltration capacities of the basins. Calculation of the organic matter additions strongly suggested that the reduced infiltration rates resulted from surface clogging. This study showed that proper management is needed if rapid infiltration basins are used for nitrogen removal by maintaining effluent infiltration in northern climates.

CR 77-01

GROWTH HISTORY OF LAKE ICE IN RELATION TO ITS STRATIGRAPHIC, CRYSTALLINE AND MECHANICAL STRUCTURE.

Gow, A.J., et al, Jan. 1977, 24p., ADA-036 228, 9 refs.

Langston, D.

32-1162

LAKE ICE, ICE GROWTH, ICE STRUCTURE, ELECTRICAL RESISTIVITY, CRYSTAL ORIENTATION, ICE MECHANICS.

Studies of the growth history and structural characteristics of winter ice covers on two New Hampshire lakes are described. These investigations included measurements of ice cover thickness, characterization of the stratigraphic and crystalline structure of the ice, identification and classification of major ice types and measurements of electrolytic conductivity. The formation of cracks and flaws in the ice and their effects on the mechanical properties of the ice were also investigated. A method of correlating ice growth with surface wind and temperature measurement is described and the interrelationships of the various physical and mechanical properties of temperate lake ice covers are discussed.

CR 77-02

COMPUTER PROGRAM TO DETERMINE THE RESISTANCE OF LONG WIRES AND RODS TO NONHOMOGENEOUS GROUND.

Arcone, S.A., Jan. 1977, 16p., ADA-036 250, 6 refs.

32-1163

COMPUTER PROGRAMS, ELECTRICAL RESISTIVITY, MODELS, FROZEN GROUND PHYSICS.

A computer program was developed for finding the d-c resistance to ground of two simple electrodes, a straight horizontal wire and a vertically driven rod. The objective of this study was to develop a rapid means of finding the resistance to ground of simple electrode types in arctic environments where a two-layer earth model, frozen and unfrozen ground, is applicable. The program can consider homogeneous as well as two-layer earth, and the length, diameter and position of the electrodes. Some specific computations are presented in comparison with previous theoretical work of other authors. The following conclusions were made: 1) A maximum run time of 165 seconds is needed for all two-layer arctic models where (a) the depth of the upper layer does not exceed 10 m, (b) the vertical rod length is less than 30 m, or (c) the horizontal wire length is less than 100 m; 2) Best accuracy is obtained when rod and wire radii are less than 0.01 m; and 3) Coincidence of the center of the vertical electrode with the two-layer interface must be avoided.

CR 77-03

EFFECT OF TEMPERATURE ON THE STRENGTH OF FROZEN SILT.

Haynes, F.D., et al, Feb. 1977, 27p., ADA-037 932, 27 refs.

Karalius, J.A.

32-1139

FROZEN GROUND STRENGTH, COMPRESSIVE STRENGTH, SEDIMENTS, TENSILE STRENGTH, STRAINS, TEMPERATURE EFFECTS, PERMAFROST, TESTS.

Tests were conducted in uniaxial compression and tension to determine the effect of temperature on the strength of frozen Fairbanks silt. Test temperatures ranged from 0C to -56.7C. Two machine speeds, 4.23 cm/sec and 0.0423 cm/sec, were used for the constant displacement rate tests. From the highest to the lowest temperature, the compressive strength increased up to about one order of magnitude and the tensile strength increased one-half an order of magnitude. Equations are presented which correlate strength with temperature at the strain rates obtained. The initial tangent and 50% strength moduli and the specific energy are given for each test. The mode of fracture and the effects of unfrozen water content and ice matrix strengthening are discussed, and the test results are compared with the data of other investigations.

CR 77-04

ST. MARYS RIVER ICE BOOMS. DESIGN FORCE ESTIMATE AND FIELD MEASUREMENTS.

Perham, R.E., Feb. 1977, 26p., ADA-037 902, 13 refs.

32-1140

ICE BOOMS, RIVER ICE, ICE STRENGTH, ICE COVER STRENGTH, ICE LOADS, ICE NAVIGATION, UNITED STATES—ST. MARYS RIVER.

A set of two ice booms with a 250-ft (76m)-wide navigation opening between them was designed to stabilize the ice cover in the harbor at Sault Ste. Marie, Michigan and Ontario, and to reduce the ice losses associated with winter navigation of ships on the St. Marys River. The forces from natural effects on the ice cover were predicted using existing theory and physical data for the area. The forces in the boom structure resulting from ice cover and boom interaction were estimated. When the ice booms were installed, force measurement systems were put into selected anchor cables. These systems were operated all winter in conjunction with a modest program of supplemental data gathering. The force data exhibited periods when the force distribution was in good agreement with predictions and periods when the effect of ice on the booms differed substantially from predictions. Sometimes passing ships had a substantial effect on the ice cover and the boom loads, and at other times, the effect was negligible. The direction of travel made little difference on average peak loads. The maximum loads on the booms resulted from natural occurrences.

CR 77-05

NUMERICAL STUDIES TO AID INTERPRETATION OF AN AIRBORNE VLF RESISTIVITY SURVEY.

Arcone, S.A., Apr. 1977, 10p., ADA-039 904, 17 refs.

32-1141

PERMAFROST, ELECTRICAL RESISTIVITY, SITE SURVEYS, VERY LOW FREQUENCIES, AIRBORNE RADAR, RADIO WAVES, ANALYSIS (MATHEMATICS).

Airborne resistivity surveys, which use the wavetilt phenomena of radiowaves, are used as a preliminary exploration technique to find suitable areas for either engineering investigations or geologic reconnaissance explorations. Survey results are usually presented as resistivity flight line profiles or as contour maps from which the interpretation or site selection process must be initiated. To aid in this process and provide additional understanding of the correlation between data obtained from airborne and ground surveys, an analysis was performed to determine a very-low-frequency airborne system's response to modelled resistivity anomalies assumed to occur at the surface of an idealized flat earth. Some of the assumptions used to simplify the analysis were based on the results of past surveys. The influences of survey altitude, anomaly size, and average ground resistivity upon airborne resistivity patterns were analyzed. The results show that the average resistivity of a region plays an important role in suppressing large resistivity contrasts for anomalies of approximately 1-sq km area. Curves are presented to separate the effects of resistivity contrast and anomaly size, and two examples are given to demonstrate how these curves may be applied to the results of actual surveys.

CR 77-06

DEFENSIVE WORKS OF SUBARCTIC SNOW.

Johnson, P.R., Apr. 1977, 23p., ADA-051 769, 11 refs.

32-2725

SNOW (CONSTRUCTION MATERIAL), SNOW DENSITY, FORTIFICATIONS, MILITARY OPERATION.

Field tests at Fort Wainwright, Alaska, carried out in March-April 1975 showed that the typical subarctic snow of interior Alaska can be used effectively to provide protection from both rifle and machine gun fire. The undisturbed snow had an average density of 0.18 g/cu cm, but simple processing, such as shoveling, increased the density to around 0.34 g/cu cm. Further processing increased the density to above 0.40 g/cu cm, but densities much above that value were difficult to obtain with simple hand equipment. Tests of the M16 rifle and M60 and M2HB machine guns showed that bullet penetration was inversely related to density—the higher the density the lower the bullet penetration. Design values for the three weapons were determined. A number of types of snow trenches and structures were designed and tested. They were found to provide good protection, in part since bullets showed a strong tendency to ricochet from the snow surface when striking it at a low angle. Burlap bags filled with snow to revet structures worked very well. Several types of Russian defensive works of snow were tested but proved unsuitable in the light, weak subarctic snow. The times required for troops to build several types of structures using only shovels and scoops were recorded.

CR 77-07

MECHANICS OF CUTTING AND BORING. PART 4: DYNAMICS AND ENERGETICS OF PARALLEL MOTION TOOLS.

Mellor, M., Apr. 1977, 85p., ADA-040 760, Bibliography p.80-82.

32-1142

DRILLING, ROCK EXCAVATION, ICE CUTTING, BOREHOLE INSTRUMENTS, PERMAFROST, METALS, DESIGN.

The report deals with the cutting of rock and similar materials by parallel motion tools. It examines cutting forces and energy requirements, taking into consideration tool geometry, wear, operating conditions, and material properties. After an introductory discussion of terminology, some general principles are outlined, and relevant theoretical ideas on metal cutting and rock cutting are reviewed. The next section, which is the heart of the report, reviews experimental data on the magnitudes and directions of cutting forces. There is a graphical compilation of data, including some from obscure or unpublished sources. The variables covered include chipping depth, rake angle, relief angle, side rake, base angle, tool width, tool compliance, tool speed, tool wear, tool interactions, and material properties. The second major part of the report treats the energetics of cutting. It begins with a short discussion of relevant principles, and continues with a compilation and review of experimental data, covering the same independent variables as the force section. The report ends with a concise summary of general behavior for parallel motion tools.

CR 77-08

REMOTE SENSING OF ACCUMULATED FRAZIL AND BRASH ICE IN THE ST. LAWRENCE RIVER.

Dean, A.M., Jr., Apr. 1977, 19p., ADA-039 905, 7 refs.

32-1143

FRAZIL ICE, ICE CONDITIONS, RIVER ICE, REMOTE SENSING, AIRBORNE RADAR, AERIAL SURVEYS, CANADA—SAINT LAWRENCE RIVER.

A broadbanded impulse radar system was used for aerial detection of accumulated frazil and brash ice in a 9.5-km reach of the St. Lawrence River near Ogden Island. The remote sensing and data reduction system developed for the project provided data sufficient for production of a contour map having 1-ft intervals. With this contour map, the accumulation pattern of frazil and brash ice could be analyzed. Recommendations are given for improving the performance of the aerial profiling system.

CR 77-09

LABORATORY INVESTIGATION OF THE MECHANICS AND HYDRAULICS OF RIVER ICE JAMS.

Tatinclaux, J.C., et al, Apr. 1977, 45p., ADA-032 471, 7 refs.

Lee, C.L., Wang, T.P., Nakato, T., Kennedy, J.F.

32-1144

ICE JAMS, ICE MECHANICS, ICE COVER STRENGTH, COMPRESSIVE PROPERTIES, ICE FLOES, ICE CONDITIONS, EXPERIMENTAL DATA.

This report presents experimental results on the conditions of initiation of an ice jam by a simple surface obstruction, on the equilibrium thickness of an ice jam formed by accumulation and submergence of ice floes, and on the compressive strength of a floating, fragmented ice cover. In the study on ice jam initiation, it was found that the minimum concentration of floes in the opening of the obstruction at which a jam occurs is nearly independent of the ratio of width of constricted passage to channel width and is proportional to a negative power of the ratio of floe length to width of constricted passage. The coefficient of proportionality and the negative exponent of this power function appear to be dependent upon the ratio of floe length to floe thickness and to be strongly affected by the properties of the material of the laboratory floes, in particular by the interparticle friction or cohesive characteristics. From energy analysis of floe submergence, a relationship between the thickness of a jam formed by accumulation and submergence of floes and the approach flow characteristics was derived and found to fit the experimental data satisfactorily. The relationship predicts that a stable jam cannot be formed when the approach flow velocity exceeds a certain value. This phenomenon was observed experimentally, and the measured maximum values of approach velocity were found to be in excellent agreement with the predicted values. In both studies on jam initiation and development, it was found that surface tension, and therefore the wetting properties of the material used for small laboratory floes, have a significant effect on the submergence velocity of small floes, and should be taken into consideration when small-scale laboratory investigations of ice jam phenomena are conducted using floes made of artificial material. Experiments on compressive strength of floating, fragmented ice covers were conducted for ranges of cover length and cover thickness, using three different floe shapes and sizes. It was found that the compressive strength was inversely proportional to compression velocity and independent of cover length. The effect of cover thickness and floe shape or size remains unclear partly because of the limited ranges of thickness and floe size investigated and partly because of the experimental scatter in the results.

CR 77-10

ICE FORCES ON VERTICAL PILES.

Nevel, D.E., et al, Apr. 1977, 9p., ADA-051 770, 16 refs.

Perham, R.E., Hogue, G.B.

32-1145

ICE PRESSURE, PILE STRUCTURES, ICE BREAKING, ICE LOADS, ICE COVER THICKNESS, AIR TEMPERATURE.

The amount of force that an ice sheet can apply to a vertical pile was tested by lowering a hydraulic ram device into a hole cut in an existing ice sheet. The device had a large base and shoved a relatively narrow vertical pile in a horizontal direction. Test variables were: pile widths—1.5 in. to 36.7 in.; pile shapes—flat, round, 45 deg and 90 deg wedges; ice thickness—2.6 in. to 8.8 in.; and ram speed—0.07 in./sec to 18.75 in./sec; but not all shapes and sizes were tested at all speeds. Air temperature was 20F (-6.7C). Forces and displacements were measured electronically. The findings are presented as a table of test results and as bar graphs of the resultant ice pressures versus the pile width-to-ice-thickness ratio, pile width and shape combination and and pile velocity. The types of failures in the ice sheet were classified as crushing, splitting, buckling, bending, and creeping. The ice sheet generally withstood a high initial load followed by several lower peak load levels. The maximum ice pressure measured was 610 psi for a 12.6-in.-diam round pile in 8.4-in.-thick ice.

CR 77-11

OBSERVATION AND ANALYSIS OF PROTECTED MEMBRANE ROOFING SYSTEMS.

Schaefer, D., et al, Apr. 1977, 40p., ADA-040 220, 5 refs.

Larsen, E.T., Aamot, H.W.C.

32-1146

ROOFS, HEAT LOSS, THERMAL INSULATION, THERMAL PROPERTIES, COLD WEATHER CONSTRUCTION, CLIMATIC FACTORS, TESTS, EFFECTIVENESS.

Two performance indicators, effectiveness and thermal efficiency, are defined and used to evaluate the year-round performance of three protected membrane roofs in Alaska and New Hampshire. Effectiveness is a measure of the deviations of ceiling temperatures from a yearly average, with large deviations indicating erratic performance in the roofing-insulation system and small departures indicating a thermally stable system. Thermal efficiency, the ratio of calculated heat loss to measured heat loss, is affected by climatic conditions such as rain, snow, solar radiation and wind. Thermal efficiency values of 100% or greater are possible since the calculated heat loss is based only on the inside and outside air temperature differences and the thermal properties of the roof components. Results of the year-round evaluation indicate that the three protected membrane roofs generally have high values of both effectiveness and thermal efficiency.

CR 77-12

ROOF LOADS RESULTING FROM RAIN-ON-SNOW.

Colbeck, S.C., May 1977, 19p., ADA-040 536, 11 refs.

32-1151

ROOFS, SNOW LOADS, LOADS (FORCES), DRAINAGE, RAIN, ANALYSIS (MATHEMATICS).

A computer program to calculate the increased live load on a snow-covered roof due to rain-on-snow is given. For the 25-year rainstorm falling on a heavy snow load on a flat roof in Hanover, New Hampshire, an additional 98 kg/sq m (20 lb/sq ft) of liquid water is added to the live load. The additional load due to rain-on-snow is very sensitive to the snow properties and characteristics of the roof. A wide range of live loads is possible, depending on the particular circumstances.

CR 77-13

APPLICATIONS OF REMOTE SENSING IN THE BOSTON URBAN STUDIES PROGRAM, PARTS I AND II.

Merry, C.J., et al, June 1977, 36p., ADA-049 285, ADA-049 286, 15 refs.

McKim, H.L.

32-2699

REMOTE SENSING, AERIAL SURVEYS, URBAN PLANNING, UNITED STATES—MASSACHUSETTS—BOSTON.

The cost effectiveness of remote sensing techniques was compared to that of the conventional techniques used by the U.S. Army Engineer Division, New England, in the Boston Harbor-Eastern Massachusetts Metropolitan Area study. A total of 6 level I, 18 level II, and 18 level III land use categories were mapped from NASA RB-57/RC-8 high altitude aircraft photography for six selected 7.5 minute quadrangles located in the Boston area. Watershed and political boundaries could not be mapped from the NASA photography. Impervious surfaces and curb lengths were mapped from low altitude aircraft photography obtained with a Zeiss RMK 15/23 camera system (measured scale 1:3500) for two sites in the Boston South and Newton quadrangles. The remote sensing procedures used in this study usually provided much greater detail than conventional procedures. The remote sensing procedures were not always cost-effective when compared to the conventional procedures, but they were always more accurate. Therefore, remote sensing techniques should be used and appropriate photographic resolution and scale factors taken into consideration when mapping land use, curb density and impervious surfaces for use in the STORM (storage, treatment, overflow, runoff) model.

CR 77-14

ICE BREAKUP ON THE CHENA RIVER 1975 AND 1976.

McFadden, T., et al, June 1977, 44p., ADA-043 070, Bibliography p.17-19.

Collins, C.M.

32-1152

ICE BREAKUP, RIVER ICE, DAMS, BRIDGES, FLOOD CONTROL, ICE COVER THICKNESS, ICE VOLUME, UNITED STATES—ALASKA—CHENA RIVER.

The breakup of the Chena River was observed and documented during the spring of 1975 and 1976. This study attempted to determine the potential for damage to the proposed Chena River flood control dam from ice and debris during breakup. Results of this study were compared to those of a 1974 companion study. In 1975, ice thicknesses were determined to be 15% thinner than in 1974 and ice volume was 33% smaller. No major ice floes were observed in 1975 and no significant flooding occurred, although the approaches to a bridge at the damsite were eroded by debris and high water immediately after breakup. The 1976 breakup was milder than that of 1975. Minor flooding in the lower river was caused by jamming of a few large ice pieces, but no property damage resulted.

CR 77-15

EXPERIMENTAL SCALING STUDY OF AN ANNULAR FLOW ICE-WATER HEAT SINK.

Stubstad, J.M., et al, June 1977, 54p., ADA-045 869, 19 refs.

Quinn, W.F.

32-1153

ICE WATER INTERFACE, HEAT TRANSFER, UNDERGROUND FACILITIES, HEAT RECOVERY, COOLING SYSTEMS, MODELS, COMPUTERIZED SIMULATION.

A laboratory experimental study was conducted on a scale model of an annular flow ice-water heat sink to be used to store the waste heat produced in a hardened defense installation operating in an isolated mode. The study examined: 1) scaling relationships for predicting the performance of prototype units using data from scale models, 2) the accuracy of a computer prediction technique developed during an earlier study, 3) the heat transfer phenomenon at the ice-water interface, and 4) some practical aspects related to the operation of a prototype installation. The scaling relationships and the computer program were found to be sufficiently accurate for use in developing a prototype sink design. During operation the scale model sink provided an almost constant low temperature source of coolant water for approximately one-half its useful life and thereafter behaved like an ordinary stored water reservoir type heat sink. No significant operational problems were discovered.

CR 77-16

ICEBREAKER SIMULATION.

Nevel, D.E., July 1977, 9p., ADA-044 109, 6 refs.

32-1154

ICEBREAKERS, ICE BREAKING, ICE NAVIGATION, MATHEMATICAL MODELS, SIMULATION.

A brief discussion is given of the ways an icebreaker breaks ice. Since the icebreaking process is so complex, the solution of a mathematical model does not appear to be feasible. As an alternative, it is suggested that physical models be used to design icebreakers. The appropriate scaling laws for physical models are developed and their practical limitation discussed.

CR 77-17

ICE ACCUMULATION ON OCEAN STRUCTURES.

Minsk, L.D., Aug. 1977, 42p., ADA-044 258, Bibliography p.17-19.

32-1155

ICE ACCRETION, ICE FORMATION, SHIP ICING, ICE PREVENTION, ICE REMOVAL, SEA SPRAY, AIR TEMPERATURE, WATER TEMPERATURE, WIND FACTORS, FREEZING POINTS.

A literature search was made for information on the accretion of ice on ocean structures and on methods for control. The bulk of the reports were in Russian, with some additional Japanese, British, American, Canadian, and Icelandic sources. Analysis of icing reports indicated that sea spray is the most important cause of ship icing, with lesser amounts due to freezing rain, snow, and fog. Icing is a potential danger whenever air temperatures are below the freezing point of water and the sea temperature is 6C or lower. Theoretical work on the ice accretion process is discussed, and a method is suggested, based on Russian experiments, for calculating the sea spray accumulation rate for cylindrical and flat surfaces as a function of water source temperature, air temperature, and wind speed. Other factors that influence icing severity are ship size and configuration, angle between ship course and water heading, and ship speed. Icing in the north temperate latitudes generally occurs in the rear of barometric depressions. Maps showing limits of various degrees of icing severity are included. Atmospheric icing measurements on tall land-based structures are presented, and potential maximum accumulations estimated. Control measures are discussed, though no completely effective method is available. Mechanical (impaction) methods are the most common, but experiments have been conducted on heated, icephobic, and deformable surfaces, and with freezing point depressants. No device for the unequivocal measurement of ice accumulation is available, though some experimental methods are suitable for controlled testing; it is recommended that a device be developed.

CR 77-18

ICE ARCHING AND THE DRIFT OF PACK ICE THROUGH RESTRICTED CHANNELS.

Sodhi, D.S., Aug. 1977, 11p., ADA-044 218, 23 refs.

32-1156

PACK ICE, SEA ICE, DRIFT, CHANNELS (WATERWAYS), ICE JAMS, MATHEMATICAL MODELS.

Models originally developed to describe the arching and the movement of granular materials through hoppers or chutes are applied to the arching and drift of pack ice in straits and gulfs having lengths of 50 to 500 km. Verification of the usefulness of the models is attempted by making comparisons with ice deformation patterns as observed via satellite imagery in the Bering Strait region and in Amundsen Gulf. The results are encouraging in that there is good correspondence between observed arching and lead patterns and those predicted by theory. In addition, values determined via the model for the angle of internal friction (approx 30 deg to 35 deg) and the cohesive strength per unit thickness (approx 2,000N/m) are similar to values obtained by other approaches. It is estimated that if the wind velocity parallel to the Bering Strait exceeds approx 6 m/s, there will be ice flow through the strait.

CR 77-19

MECHANICS OF CUTTING AND BORING. PART 6: DYNAMICS AND ENERGETICS OF TRANSVERSE ROTATION MACHINES.

Mellor, M., Aug. 1977, 36p., ADA-045 127, 3 refs.

32-1157

ROCK DRILLING, EXCAVATION, ICE CUTTING, DRILLS, PERMAFROST, DESIGN.

The report deals with forces and power levels in cutting machines having a disc or drum that rotates about an axis perpendicular to the direction of advance. The forces on individual cutting tools are related to position on the rotor and to characteristics such as tool layout, rotor speed, rotor size, machine advance speed, and rotor torque. Integration leads to expressions for force components acting on the rotor axis, taking into account tool characteristics, cutting depth of the rotor, and rotor torque. These provide estimates of tractive thrust and thrust normal to the primary free surface. For self-propelled machines, this leads to considerations of traction, normal reaction, weight and balance, and power/weight ratios. Specific energy consumption is analyzed and related to machine characteristics and strength of the material being cut. Power per unit working area is discussed, and data for existing machines are summarized. Power requirements for ejection of cuttings are analyzed, and the hydrodynamic resistance on underwater cuttings is treated. A number of worked examples are given to illustrate the principles discussed in the report.

CR 77-20

INVESTIGATION OF AN AIRBORNE RESISTIVITY SURVEY CONDUCTED AT VERY LOW FREQUENCY.

Arcone, S.A., Aug. 1977, 48p., ADA-044 684, Bibliography p.44-45.

32-1158

AERIAL SURVEYS, REMOTE SENSING, AIRBORNE RADAR, ELECTRICAL RESISTIVITY, GEOLOGIC STRUCTURES, VERY LOW FREQUENCY, GEOPHYSICAL SURVEYS, SUBSURFACE INVESTIGATIONS, UNITED STATES—MAINE—ALLAGASH.

An airborne survey of earth electrical resistivity, computed from the complex tilt of the electric field vector of a VLF (17.8 kHz) radio surface wave, has been studied. The survey was conducted at a 150-m mean flight altitude. The bedrock of the survey area was slate containing an igneous stock. Topography was found to distort the resistivity contours through its effect upon the vertical component of the electric field. At 300-m flight altitude most resistivity information was retained due to the deterioration of topographic influence. The phase of the tilt, which cannot be distinguished from the amplitude by an airborne antenna system, was determined from a ground survey of the surface impedance and was found to be an important influence on the airborne detection of high resistivity areas. The entire 150-m survey was reevaluated with topographic effects removed. The resolution of the igneous geology improved and several of these improvements were verified by the ground measurements.

CR 77-21

MID-WINTER INSTALLATION OF PROTECTED MEMBRANE ROOFS IN ALASKA.

Aamot, H.W.C., Aug. 1977, 5p., ADA-045 356, 2 refs.

32-1159

ROOFS, THERMAL INSULATION, COLD WEATHER CONSTRUCTION, COST ANALYSIS, UNITED STATES—ALASKA.

Cold weather limits the successful application of built-up roofing, but often a roof installation must be completed late in the fall or in the winter. The loose-laid protected membrane roof with a synthetic sheet membrane can be installed in the middle of the winter with complete reliability. A synthetic membrane is traditionally more expensive than built-up roofing (rising crude oil prices, however, have reversed this condition), but it has two special features besides its suitability for winter installation: it can be placed on a damp deck, if necessary, and, being loose-laid, it does not split because of deck movement. This report documents information on the installation of two roofs in Anchorage, Alaska, during January and February 1972, including a discussion of the necessary snow removal from the bare deck and the use of portable shelters for preparing the lap joints between sheets during very cold weather. The winter installation caused no special construction problems and the advantages of the synthetic membrane make it an attractive alternative to built-up roofing. The cost of loose-laid protected membrane roofs in Alaska was, in 1972, nearly $300 per square ($28/sq m), including insulation. Prices are rising as labor costs rise and as more insulation is specified.

CR 77-22

BASEPLATE DESIGN AND PERFORMANCE: MORTAR STABILITY REPORT.

Aitken, G.W., Aug. 1977, 28p., ADB-021 703L, 4 refs.
Distribution limited to U.S. Gov't. agencies only.

32-1237

MILITARY EQUIPMENT, SOIL STRENGTH, STATIC STABILITY, FOUNDATIONS.

The results of field test programs conducted to evaluate the performance of several prototype baseplates on sand and clay soils are presented. One test series was accomplished to develop a possible alternative baseplate for the 60-mm Lightweight Company Mortar System (LWCMS). Three prototype baseplates were used in this series which resulted in design recommendations for a very lightweight, three-spade baseplate for use with the LWCMS. Another part of the program consisted of design and testing of a prototype baseplate for use with an improved 81-mm mortar system. Design goals, which were verified in the test program, were to provide a displacement reduction of up to 50% and substantial reductions in tilt relative to the present M3 baseplate. Results obtained using a baseplate test fixture having spades of variable depth and configuration indicated that spade depth was very important on sand but of minor influence on clay. The influence of spade depth on displacement and tilt in both three- and four-spade configurations is covered in detail. Some data on the influence of socket height and perforation pattern on performance are also included.

CR 77-23

COLLABORATION OF ARCHITECT AND BEHAVIORAL SCIENTIST IN RESEARCH.

Ledbetter, C.B., Aug. 1977, 8p., ADA-045 418, 33 refs.

32-1160

COLD WEATHER CONSTRUCTION, BUILDINGS, ENVIRONMENTS, PROFESSIONAL PERSONNEL, RESEARCH PROJECTS, HOUSES.

This report discusses the relationship between an architect and a behavioral scientist. Some of the discussion applies to this cooperative work for design of buildings. The bulk, however, relates to the cooperation of architect and behavioral scientist while conducting research. Examples from collaborative research at Alaskan military installations are cited which demonstrate the roles and contributions of the two disciplines.

CR 77-24

EVALUATION OF EXISTING SYSTEMS FOR LAND TREATMENT OF WASTEWATER AT MANTECA, CALIFORNIA, AND QUINCY, WASHINGTON.

Iskandar, I.K., et al, Sep. 1977, 34p., ADA-045 357, 28 refs.

Murrmann, R.P., Leggett, D.C.

32-1161

WASTE DISPOSAL, GROUND WATER, SOIL CHEMISTRY, LAND DEVELOPMENT, WATER TREATMENT, ENVIRONMENTAL IMPACT.

Wastewater disposal sites at Manteca, California, and Quincy, Washington, were evaluated for their current performance and for the long-term impact of wastewater application. These sites have been operated as slow-infiltration, land-disposal systems for up to 20 years. Current performance was evaluated in terms of water quality, while soil chemical parameters were measured to determine the effects of prolonged wastewater application at the sites. No significant effects on the performance were found to be due to differences in pretreatment. A difference between the performances of the two sites was attributed mainly to management practices, site history and climatic differences. While leaching of nitrate was observed at both sites, the impact on groundwater quality generally was found to be within the accepted limits (less than 10 mg/l of NO3-N). Leaching of phosphorus to a depth of 150 cm was found at both sites but was higher at Manteca. This was thought to be due to problems associated with crop menagement, land use, and mode and schedule of wastewater application. Total and extractable phosphorus increased in the surface soil layers with time. However, soil nitrogen appeared to decrease, probably because of mineralization. Soil organic matter and cation exchange capacity increased. Some increase in exchangeable Na was noted, but not enough to produce alkaline or saline conditions. A drop in soil pH at Quincy after prolonged application is thought to have been due to removal of carbonates by leaching and by H+ from nitrification. If these disposal areas were managed as treatment sites, leachate quality should meet proposed Environmental Protection Agency guidelines for drinking waters.

CR 77-25

DETECTION OF MOISTURE IN CONSTRUCTION MATERIALS.

Morey, R.M., et al, Sep. 1977, 9p., ADA-045 353, 4 refs.

Kovacs, A.

32-1164

CONCRETE CURING, CONSTRUCTION MATERIALS, MOISTURE, ROOFS, AIRBORNE RADAR, REMOTE SENSING, DETECTION, CONCRETE DURABILITY, RADAR ECHOES.

Results of a study to determine the feasibility of using an impulse radar to detect moisture variations in the built-up roof at CRREL and to monitor the curing of concrete are presented. The results indicate that impulse radar can be used to detect wide variations in roof moisture associated with built-up roof surface deterioration and that this technique has the potential of providing a nondestructive test method for measuring the strength of concrete during curing.

CR 77-26

INTERMITTENT ICE FORCES ACTING ON INCLINED WEDGES.

Tryde, P., Oct. 1977, 26p., ADA-046 590, 15 refs.

32-1165

ICE LOADS, LOADS (FORCES), ICE PRESSURE, WEDGES, ANALYSIS (MATHEMATICS), THEORIES.

A theory for ice forces acting on inclined wedges has been developed, thus making it possible to predict the magnitude of the intermittent ice forces from knowledge of the physical parameters of the system. The theory has been verified by model tests with artificial and natural ice.

CR 77-27

OBSERVATIONS OF THE ULTRAVIOLET SPECTRAL REFLECTANCE OF SNOW.

O'Brien, H.W., Oct. 1977, 19p., ADA-046 349, 11 refs.

32-1166

SNOW OPTICS, REFLECTIVITY, SPECTROPHOTOMETERS, ULTRAVIOLET RADIATION.

The spectral reflectance of natural snow in the range of 0.20- to about 0.40-micron wavelengths was studied in the laboratory using both continuous spectral scanning and fixed bandpass measurements. White barium sulfate pressed powder was used as a standard for comparison. The reflectance of fresh snow was found to be very high (usually nearly 100%) and only weakly wavelength dependent from 0.24 micron to the visible range. In the 0.20- to 0.24-micron portion of the spectrum, the reflectance was found to be quite erratic. Possible reasons for the irregularities in reflectance measurements are discussed.

CR 77-28
FREEZE-THAW TESTS OF LIQUID DEICING CHEMICALS ON SELECTED PAVEMENT MATERIALS.
Minsk, L.D., Nov. 1977, 16p., ADA-051 771, 7 refs.
32-2726
FREEZE THAW TESTS, CHEMICAL ICE PREVENTION, CONCRETE DURABILITY, BITUMINOUS CONCRETES.

Tests were conducted to assess the extent of surface degradation resulting from the application of non-chloride deicing chemicals on three types of airfield pavements. The chemicals tested were proprietary mixtures of urea, formamide, and ethylene glycol; sodium chloride, distilled water, and dry specimens were used as controls and for comparison. Pavements included new and old specimens of open-graded asphaltic concrete and old specimens of dense-graded asphaltic concrete. Portland cement concrete specimens used were new and old, with and without air-entrainment. New and old tar rubber concrete specimens were also tested. Samples were subjected to up to 60 freeze-thaw cycles with deicing chemicals flooding their upper surface. Each specimen was rated on a scale of 0-5 after every five freeze-thaw cycles. All PCC specimens showed some surface degradation, whereas the dense- and open-graded asphaltic concretes were largely unaffected.

CR 77-29
INTERNAL STRUCTURE OF FAST ICE NEAR NARWAHL ISLAND, BEAUFORT SEA, ALASKA.
Gow, A.J., et al, Oct. 1977, 8p., ADA-047 785, 13 refs.
Weeks, W.F.
32-2727
FAST ICE, ICE STRUCTURE.

Results of measurements of salinity, grain size, substructure dimensions and crystal fabrics of the undeformed 2.15-m-thick annual sea ice sheet near Narwhal Island, Alaska, are presented. A notable observation was the formation of a dominant c-axis horizontal structure in all ice below 14 cm, including transformation to a pronounced east-west alignment of the c-axes by a depth of 66 cm. This study confirms earlier reports of the occurrence of very strong horizontal c-axis alignments in arctic fast ice.

CR 77-30
COMPUTER MODEL OF MUNICIPAL SNOW REMOVAL.
Tucker, W.B., Nov. 1977, 7p., ADA-047 360, 10 refs.
32-1630
SNOW REMOVAL, URBAN PLANNING, COMPUTERIZED SIMULATION.

A general computer model to simulate municipal snow removal has been developed. Programs which aid in the routing of snowplows are a part of this package. Once vehicle routes are created, the simulation program can be used to assess situations varying both equipment and meteorological parameters. Time for each plow to complete its route is calculated. Considerations are made for the above variable parameters plus plowing windrow, route starting depth, overlapping truck routes and intersection delay time. The effects of storm length, snowfall rate and starting depth on total plowing time are examined in a test case.

CR 77-31
ROOF MOISTURE SURVEY: TEN STATE OF NEW HAMPSHIRE BUILDINGS.
Tobiasson, W., et al, Dec. 1977, 29p., ADA-048 986, 5 refs.
Korhonen, C., Dudley, T.
32-2695
ROOFS, WATER CONTENT, INFRARED PHOTOGRAPHY.

Ten roofs in Concord, New Hampshire, were surveyed for wet insulation using a hand-held infrared camera. Suspected wet areas were marked on the roof with spray paint and roof samples were obtained to verify wet and dry conditions. Recommendations for maintenance and repair were made based on infrared findings, water contents, and visual examinations. An incremental economic study is presented to serve as a guide in determining the most cost-effective approach.

CR 77-32
HEAT TRANSFER OVER A VERTICAL MELTING PLATE.
Yen, Y.-C., et al, Dec. 1977, 12p., ADA-049 437, 11 refs.
Hart, M.M.
32-2696
HEAT TRANSFER, CONVECTION, ICE MELTING, WATER FLOW, EXPERIMENTAL DATA.

An experimental study of forced convective heat transfer over a vertical melting plate has been conducted. This study covers water velocities ranging from 1.7 to 9.8 mm/s and bulk water temperatures from 1.11 to 7.50C. The experimental results are correlated in terms of Nusselt, Prandtl and Reynolds numbers with a moderate correlation coefficient of 0.843. The results are expected to be useful in predicting the heat transfer characteristics of a much larger prototype ice-water heat sink.

CR 78-01
AXIAL DOUBLE POINT-LOAD TESTS ON SNOW AND ICE.
Kovacs, A., Mar. 1978, 11p., ADA-053 321, 11 refs.
32-3535
ICE MECHANICS, SNOW MECHANICS, COMPRESSIVE STRENGTH, INDEXES (RATIOS), STRAIN TESTS, ANTARCTICA—MCMURDO SOUND.

The results of axial double point-load tests on disk samples of snow and ice obtained from the area of McMurdo Sound, Antarctica, are presented. They show the effects of temperature, sample length, load point diameter and specific gravity on failure load. It was determined that 13 samples should be tested to obtain a representative mean strength index. The results show that the axial double point-load test has good possibilities as a rapid field test for determining the unconfined compressive strength of snow and ice but that further evaluation of the variables affecting test results must be made. (Auth.)

CR 78-02
SOME ELEMENTS OF ICEBERG TECHNOLOGY.
Weeks, W.F., et al, Mar. 1978, 31p., ADA-053 431, 52 refs.
Mellor, M.
32-3536
ICEBERG TOWING, ICE (WATER STORAGE), ENGINEERING.

Many of the technical questions relating to iceberg transport are given brief, but quantitative, consideration. These include iceberg genesis and properties, the mechanical stability of icebergs at sea, towing forces and tug characteristics, drag coefficients, ablation rates, and handling and processing the iceberg at both the pick-up site and at the final destination. In particular, the paper attempts to make technical information on glaciological and ice engineering aspects of the problem more readily available to the interested planner or engineer. Specific conclusions include: 1) No unprotected iceberg, no matter how long or wide, would be likely to survive the ablation caused by a long trip to low latitudes. 2) Icebergs that have a horizontal dimension exceeding 2 km may well be prone to breakup by long wavelength swells. 3) To avoid the dangers associated with an iceberg capsizing, the width of a 200-m-thick iceberg should always be more than 300 m. 4) For towing efficiency the length/width ratio of a towed iceberg should be appreciably greater than unity. 5) For a pilot project, the selected iceberg would have to be quite small, if for no other reason than the practical availability of tug power. (Auth.)

CR 78-03
BEARING CAPACITY OF RIVER ICE FOR VEHICLES.
Nevel, D.E., Apr. 1978, 22p., ADA-055 244, 7 refs.
33-2527
RIVER ICE, ICE STRENGTH, VEHICLES, FLOATING ICE.

The mathematical theory for the bearing capacity of river ice for vehicles is presented. The floating ice sheet is assumed to have simple supports at the shore line. Solutions are presented for loads uniformly distributed over circular and rectangular areas. Numerical evaluations are made for a number of vehicles and the results presented in graphical form.

CR 78-04
COMPARISON BETWEEN DERIVED INTERNAL DIELECTRIC PROPERTIES AND RADIO-ECHO SOUNDING RECORDS OF THE ICE SHEET AT CAPE FOLGER, ANTARCTICA.
Keliher, T.E., et al, Apr. 1978, 12p., ADA-055 245, 17 refs.
Ackley, S.F.
32-4366
ICE SHEETS, ICE ELECTRICAL PROPERTIES, ICE PHYSICS, RADIO ECHO SOUNDINGS, DIELECTRIC PROPERTIES, ICE COVER THICKNESS, ICE DENSITY, ANTARCTICA—FOLGER, CAPE.

Measured physical properties of core to bedrock taken at Cape Folger, East Antarctica, are used to compute a profile of dielectric properties and from this, a depth-reflection coefficient profile for comparison with the observed radio-echo reflections. The measurements available on physical properties are: density variations, bubble size and shape changes, and crystal fabric variations. The close correspondence between the depths of the bubble shape changes (which are definitely deformational features), and the depths of the density variations, and between both of these and the radio-echo layers, indicates that deformational events in the ice sheet's history are represented by the variations in the physical property and associated radio-echo records. (Auth. mod.)

CR 78-05
VISCOELASTIC DEFLECTION OF AN INFINITE FLOATING ICE PLATE SUBJECTED TO A CIRCULAR LOAD.
Takagi, S., Apr. 1978, 32p., ADA-054 896, 19 refs.
32-4367
FLOATING ICE, PLATES, VISCOELASTICITY, LOADS (FORCES), ANALYSIS (MATHEMATICS).

The viscoelastic deflection of an infinite floating ice plate subjected to a circular load is solved, assuming the Maxwell-Voigt type four-element model. An effective method is developed for numerical integration of the solution integrals, of which each integrand contains a product of Bessel functions extending to infinity. The theoretical curve is fitted to the field data, but the material constants thus found varied with time and location.

CR 78-06
SEGREGATION FREEZING AS THE CAUSE OF SUCTION FORCE FOR ICE LENS FORMATION.
Takagi, S., Apr. 1978, 13p., ADA-055 780, 38 refs.
For another version see 32-3470.
32-4368
ICE LENSES, ICE FORMATION, SOIL FREEZING, GROUND ICE, FROST HEAVE, SOIL MECHANICS, MATHEMATICAL MODELS, FROZEN GROUND THERMODYNAMICS.

CR 78-07
IN-PLANE DEFORMATION OF NON-COAXIAL PLASTIC SOIL.
Takagi, S., Apr. 1978, 28p., ADA-054 217, 28 refs.
32-3962
THEORIES, SOIL CREEP, PLASTIC DEFORMATION, BOUNDARY VALUE PROBLEMS.

The theory of non-coaxial in-plane plastic deformation of soils that obey the Coulomb yield criterion is presented. The constitutive equations are derived by use of the geometry of the Mohr circle and the theory of characteristic lines. It is found that, for solving a boundary value problem, the non-coaxial angle must be given such values that enable us to accommodate the presupposed type of flow in the given domain satisfying the given boundary conditions. The non-coaxial angle is contained in the constitutive equations as a parameter. Therefore, the plastic material obeying the Coulomb yield criterion is a singular material whose constitutive equations are not constant with material but are variable with flow conditions.

CR 78-08
INTERACTION OF A SURFACE WAVE WITH A DIELECTRIC SLAB DISCONTINUITY.
Arcone, S.A., et al, Apr. 1978, 10p., ADA-055 956, 15 refs.
Delaney, A.J.
32-4369
ICE ELECTRICAL PROPERTIES, DIELECTRIC PROPERTIES, WAVE PROPAGATION, ELECTRIC FIELDS, MICROWAVES, AIRCRAFT ICING, HELICOPTERS, ICE REMOVAL.

The interaction of a 5.1-GHz transverse electric surface wave with a dielectric slab is experimentally investigated. The wave is initially supported by a dielectric substrate resting upon a metallic ground-plane. A slab, made of the same dielectric material as the substrate and variable in height, is then placed upon the waveguide. The results for a small slab sitting on the substrate showed that the discontinuity was a very inefficient launcher of reflected surface waves. Investigations of these reflections with a trough waveguide showed that, for values of slab height comparable to the exponential decay height of the surface wave, the reflections remain very small. However, as the slab height is increased beyond the decay height, the reflected amplitude approaches the theoretical value for a plane wave reflected from the interface between air and the same dielectric. The results are applicable to surface wave methods of microwave deicing of wings and helicopter rotors.

CR 78-09
FLEXURAL STRENGTH OF ICE ON TEMPERATE LAKES—COMPARATIVE TESTS OF LARGE CANTILEVER AND SIMPLY SUPPORTED BEAMS.
Gow, A.J., et al, Apr. 1978, 14p., ADA-054 218, 9 refs.
Ueda, H.T., Ricard, J.A.
32-3963
LAKE ICE, FLEXURAL STRENGTH, STRESS CONCENTRATION, SUPPORTS.

Large, simply supported beams of temperate lake ice were found, generally, to yield significantly higher flexural strengths than the same beams tested in the cantilever mode. Data support the view that a significant stress concentration may exist at the fixed corners of the cantilever beams. Maximum effects are experienced with beams of cold, brittle ice substantially free of structural imperfections; for this kind of ice the strength difference factor, here attributed to the effect of stress concentrations, may exceed 2.0; that is, simply supported beams test a factor of 2 or more stronger than the same beams tested in the cantilever mode. In ice that has undergone extensive thermal degradation, the stress concentration effect may he eliminated entirely. Simply supported beams generally yield higher strengths when the top surfaces are placed in tension. This behavior is attributed to differences in ice type; the fine-grained, crack-free top layer of snow-ice, which constituted up to 50% of the ice cover in the current series of tests, usually reacted more strongly in tension than the coarse-grained crack-prone bottom lake ice.

CR 78-10

COMPRESSION OF WET SNOW.

Colbeck, S.C., et al, Apr. 1978, 17p., ADA-055 246, 34 refs.

Shaw, K.A., Lemieux, G.

32-4370

WET SNOW, SNOW COMPRESSION, SNOW WATER CONTENT, VISCOSITY, SALINITY, SNOW MELTING, STRESSES, IONS.

The compressibility of wet snow is described in terms of pressure melting and nonlinear viscous deformation at grain contacts. The results of experiments with different salinities and liquid water contents are compared with computed densities. The decreasing compressibility of wet snow with increasing salinity and decreasing liquid content is quantified and explained. Simultaneous particle growth and the doubly charged layer at phase boundaries are included in the model. The results show that the density of wet snow increases approximately as a power of time but is highly dependent on the stress, initial particle size, liquid water content, and ionic impurity content of the snow.

CR 78-11

MECHANICS OF CUTTING AND BORING. PART 8: DYNAMICS AND ENERGETICS OF CONTINUOUS BELT MACHINES.

Mellor, M., Apr. 1978, 24p., ADA-055 247.

32-4371

ROCK EXCAVATION, BOREHOLE INSTRUMENTS, ROCK DRILLING, EXCAVATION, ICE CUTTING, MACHINERY, PERMAFROST, DESIGN.

The report deals with forces and power requirements for cutting machines of the belt type, as exemplified by large chain saws and ladder trenchers. The forces of single cutting tools are considered, and related to the overall forces on a cutter bar. Forces are related to power, and sources of loss are identified. Tractive thrust and normal reaction are analyzed and used to assess the traction, weight and balance factors for self-propelled machines. Specific energy consumption and performance index are treated, and concepts of power density and apparent belt pressure are introduced. Requirements for acceleration of cuttings are assessed, and the report concludes with a set of worked examples.

CR 78-12

REPETITIVE LOADING TESTS ON MEMBRANE-ENVELOPED ROAD SECTIONS DURING FREEZE-THAW CYCLES.

Smith, N., et al, May 1978, 16p., ADA-056 744, 15 refs.

Eaton, R.A., Stubstad, J.M.

32-4407

LOADS (FORCES), ROADS, FREEZE THAW CYCLES, LOW TEMPERATURE TESTS, SUBGRADE PREPARATION, WATERPROOFING, SOIL WATER MIGRATION.

Road test sections of membrane-enveloped silt and clay soils overlain with asphalt cement concrete were subjected to repetitive dynamic plate-bearing loadings to determine their strength variations during freeze-thaw cycles. The recoverable surface deformations in the load deflection bowl were continuously measured during the loading cycles and analyzed, using the Chevron layered elastic computer program to obtain the in situ resilient deformation modulus of the various section layers at different stages of the freeze-thaw cycles. The resilient stiffness of the pavement system (the total load per unit of resilient load plate deflection) was also calculated for the various freeze-thaw conditions. The modulus values of the asphalt cement concrete varied inversely with its temperature by an order of magnitude (90,000 psi to 1,300,000 psi). The resilient stiffness of the pavement system varied in the same manner by nearly a factor of eight (228.4 kips/in. to 1740.2 kips/in.). Despite the wide strength variations of the sections during freeze-thaw cycles, membrane-enveloped fine-grained soils can be utilized instead of granular materials as base and subbase layers in flexible pavements in cold regions where moisture migration is a major concern. Moisture migration did not occur at saturation levels up to 75%; thus there was no strength loss during thawing.

CR 78-13

PREFERRED CRYSTAL ORIENTATIONS IN THE FAST ICE ALONG THE MARGINS OF THE ARCTIC OCEAN.

Weeks, W.F., et al, June 1978, 24p., ADA-059 024, 77 refs.

Gow, A.J.

33-1520

SEA ICE, FAST ICE, ICE CRYSTAL STRUCTURE, OCEAN CURRENTS.

Field observations of the growth fabrics of the fast and near-fast ice along the coasts of the Beaufort and Chukchi Seas show that, at depths of more than 60 cm below the upper ice surface, the sea ice crystals show striking alignments within the horizontal plane. In general, the c-axes of the crystals were aligned roughly E-W parallel to the coast. In the vicinity of islands the alignment roughly paralleled the outlines of the islands, and in narrow passes between islands the alignment paralleled the channel. Our observations, as well as similar observations made in the Kara Sea by Cherepanov, can be explained if it is assumed that the c-axes of the crystals are aligned parallel to the "long-term" current direction at the sea ice/sea water interface. The alignments are believed to be the result of geometric selection among the growing crystals, with the most favored orientation being that in which the current flows normal to the plates of ice that make up the dendritic ice/water interface characteristic of sea ice.

CR 78-14

BUCKLING PRESSURE OF AN ELASTIC PLATE FLOATING ON WATER AND STRESSED UNIFORMLY ALONG THE PERIPHERY OF AN INTERNAL HOLE.

Takagi, S., June 1978, 49p., ADA-056 585, 10 refs.

32-4408

FLOATING ICE, ICE STRENGTH, BOUNDARY VALUE PROBLEMS, ANALYSIS (MATHEMATICS).

The analytical solution and the numerical study of the eigenvalue problem for determining the buckling pressure of an infinite elastic plate floating on water and stressed uniformly along the periphery of an internal hole is presented. The boundary conditions considered are the clamped-, simple-, and free-edge condtitions. Small buckling pressure occurs only for the free-edge condition. The shape of the deflection for the free-edge condition suggests that buckling is an important mechanism of failure.

CR 78-15

ON THE DETERMINATION OF HORIZONTAL FORCES A FLOATING ICE PLATE EXERTS ON A STRUCTURE.

Kerr, A.D., Aug. 1978, 9p., ADA-060 444, 26 refs.

For this report from a different source see 32-4451.

33-1521

FLOATING ICE, ICE PRESSURE, LOADS (FORCES), OFFSHORE STRUCTURES, ICE STRENGTH.

This report first discusses the general approach for calculating horizontal forces an ice cover exerts on a structure. Ice force determination consists of two parts: (1) the analysis of the in-plane forces, assuming that the ice cover remains intact, and (2) the use of a failure criterion, since an ice force cannot be larger than the force capable of breaking up the ice cover. For an estimate of the largest ice force, an elastic plate analysis and a failure criterion are often sufficient. A review of the literature revealed that, in the majority of the analyses, it is assumed that the failure load is directly related to a "crushing strength" of the ice cover. However, observations in the field and tests in the laboratory show that in some instances the ice cover fails by buckling. This report reviews the ice force analyses based on the buckling failure mechanism and points out their shortcomings. The report then presents a new method of analysis which is based on the buckling mechanism.

CR 78-16

HYDRAULIC MODEL INVESTIGATION OF DRIFTING SNOW.

Wuebben, J.L., June 1978, 29p., ADA-059 175.

33-1767

HYDRAULIC STRUCTURES, SNOWDRIFTS, MODELS, BOUNDARY VALUE PROBLEMS, SNOW FENCES.

A model investigation of drifting snow conditions was conducted in a hydraulic flume using a sand-water analog. Model results were evaluated to define modeling parameters that would allow quantitative correlation between measured prototype drift conditions and the model. Models of the fence were constructed for three heights and two geometric scales. Geometric scaling was based on terrain roughness and boundary layer thickness considerations, while velocity scaling was based on particle fall velocity and threshold of motion characteristics. Simulation of the atmospheric boundary layer was found to be of primary importance. Velocity scaling analysis suggested the use of a 'significant wind' concept, based on a combination of velocity magnitude and frequency. Similarity of precipitation rate was not essential, and could be altered within limits to adjust the time scale.

CR 78-17

SHORELINE CHANGES ALONG THE OUTER SHORE OF CAPE COD FROM LONG POINT TO MONOMOY POINT.

Gatto, L.W., July 1978, 49p., ADA-060 297, 52 refs.

33-1522

SHORELINE MODIFICATION, AERIAL SURVEYS, PHOTOINTERPRETATION.

This investigation utilized historical and recent aerial photographs and satellite imagery in 1) estimating changes in positions of the high-water line and sea cliff break and base, in rates of accretion and/or erosion, and in volumes of transported sediment, and 2) providing a preliminary evaluation of the direction of littoral transport along the outer Cape Cod coast. This investigation has illustrated a photo interpretation technique that is useful in performing a reconnaissance of coastal change. The data obtained from this method can be used to supplement those acquired by ground surveys and are valid as first approximations for planning subsequent, more detailed surveys.

CR 78-18

ESTUARINE PROCESSES AND INTERTIDAL HABITATS IN GRAYS HARBOR, WASHINGTON: A DEMONSTRATION OF REMOTE SENSING TECHNIQUES.

Gatto, L.W., July 1978, 79p., ADA-061 823, 49 refs.

33-1523

ESTUARIES, SHORELINE MODIFICATION, REMOTE SENSING, AERIAL SURVEYS, SPACEBORNE PHOTOGRAPHY, TIDAL CURRENTS, SEDIMENTATION, MAPPING.

The primary objective of this project was to demonstrate the utility of remote sensing techniques as an operational tool in the acquisition of data required by the U.S. Army Corps of Engineers, Seattle District, in the Grays Harbor dredging effects project, and related projects. Aerial imagery was used to map surface circulation and suspended sediment patterns near the hopper dredge pump site at the harbor entrance and near pulpmill outfalls in Aberdeen, and to map the areal distribution and extent of intertidal habitats. The surface circulation maps, prepared from the aerial photographs and thermal imagery, compared favorably with the large-scale circulation patterns observed in the Grays Harbor hydraulic model at the U.S. Army Engineer Waterways Experiment Station. Of the imagery provided by NASA, the thermal imagery was more useful than the color or color infrared (CIR) photographs for mapping circulation, while the CIR photographs were more useful than the thermal imagery or the color photographs for mapping intertidal habitats. Current velocities estimated from dye dispersion patterns and drifting dye drogues were comparable at some locations to velocities measured by in situ current meters and in the hydraulic model. Based on a cursory evaluation of LANDSAT-1 imagery acquired in January, February, and October 1973, it had limited utility in providing data on surface circulation patterns in Grays Harbor.

CR 78-19

PRIMARY PRODUCTIVITY IN SEA ICE OF THE WEDDELL REGION.

Ackley, S.F., et al, July 1978, 17p., ADA-059 344, 24 refs.

Taguchi, S., Buck, K.R.

33-1524

SEA ICE, ICE CORES, BIOMASS, WEDDELL SEA.

Physical and biological measurements were made of sea ice cores taken from 68S to 78S in the Weddell Sea. Fluorescence measurements indicated an algal community that was strongly associated with salinity maxima within the ice. Maximum concentration of chlorophyll *a* ranged from 0.306 to 4.54 mg/stere. Comparisons with the water column standing crop indicated that the standing crop within the ice represents a minor but significant percentage of the total standing crop for the region. The ice algal community is apparently distinct from others that have been described for land-fast ice in McMurdo Sound, sea ice in the Arctic and pack ice off East Antarctica. The highest concentrations of biological material are found in the bottom or top of the sample in those regions, whereas the Weddell Sea samples are concentrated at intermediate depths (.65 m to 2.15 m) within the ice. A qualitative model indicating the relationship between thermally-induced brine migration and subsequent algae growth is presented. This model indicates the distribution of algae within the ice is dependent on the unique thermal and physical setting for Weddell Sea pack ice where brine drainage processes are initiated by spring and summer warming, but are not carried through as completely as in other regions. (Auth.)

CR 78-20

MEASUREMENT AND IDENTIFICATION OF AEROSOLS COLLECTED NEAR BARROW, ALASKA.

Kumai, M., July 1978, 6p., ADA-058 606, 9 refs.

33-1525

AEROSOLS, PARTICLE SIZE DISTRIBUTION, ELECTRON MICROSCOPY.

Measurements of the concentrations of Aitken nuclei in maritime air were made near Barrow, Alaska, in June 1975, with a modified Nolan-Pollack small-particle detector. The concentrations varied from 50 to 300 particles/cu cm, depending upon meteorological conditions. The mean Aitken nuclei count was 100 particles/cu cm for diameters greater than .002 microns. Transmission electron micrographs of aerosols in maritime air near Barrow were taken. The size range was measured to be 0.01 to 2.5 microns in diameter, with the most frequently observed diameter being 0.04 microns. The volume of the maritime air and the collection efficiency of aerosol particles on filmed grids for electron microscopy were measured. The aerosol concentrations were found to be 76 to 101 particles/cu cm; the mean concentration was calculated to be 87 particles/cu cm. The aerosol particles in the maritime air were identified by electron microscopy and selected area electron diffraction analysis. About 20% of the aerosol particles were identified, and 80% of the particles were too small for electron diffraction analysis.

CR 78-21

ANALYSIS OF THE MIDWINTER TEMPERATURE REGIME AND SNOW OCCURRENCE IN GERMANY.

Bilello, M.A., et al, Sep. 1978, 56p., ADA-066 934.
Appel, G.C.
33-4415
AIR TEMPERATURE, SNOWFALL, METEOROLOGICAL DATA, WEATHER FORECASTING, STATISTICAL ANALYSIS.

This study investigates the possibility of providing estimates of the time of occurrence and length of the freezing season for any location in East and West Germany by using the average January air temperature (AJAT) as an index. The results indicate that reliable values of the mean freezing index can be obtained from the AJAT relationships which are developed for Germany. This association is further verified using data from the northeastern part of the U.S., and the AJAT is then used to determine the average starting and ending dates (and hence the probable length) of the freezing season for stations in Germany. The AJAT and the average dates of snowfall occurrence for numerous locations in the U.S. and Germany are also correlated. Interrelationships between these parameters and the average number of days with snow on the ground for stations up to 3000 m in elevation in Germany are examined.

CR 78-22

UNDERSEA PIPELINES AND CABLES IN POLAR WATERS.

Mellor, M., Sep. 1978, 34p., ADA-086 161, 19 refs.
34-3448
PIPELINES, TRANSMISSION LINES, HYDRAULIC STRUCTURES, DAMAGE, ENGINEERING, EXCAVATION, SEA ICE, SUBSEA PERMAFROST, ICE SCORING, POLAR REGIONS.

Special environmental factors that influence the design, laying and maintenance of undersea pipelines and cables in polar waters are described. Various approaches to the protection of submarine pipes and cables are considered, and prime emphasis is given to burial techniques for shallow water. A wide range of methods for trenching and burying are discussed, and technical data are given.

CR 78-23

INFLUENCE OF FREEZING AND THAWING ON THE RESILIENT PROPERTIES OF A SILT SOIL BENEATH AN ASPHALT CONCRETE PAVEMENT.

Johnson, T.C., et al, Sep. 1978, 59p., See also 32-3761.
Cole, D.M., Chamberlain, E.J.
33-3128
BITUMINOUS CONCRETES, SUBGRADE SOILS, SOIL FREEZING, GROUND THAWING, ELASTIC PROPERTIES.

Stress-deformation data for silt subgrade soil were obtained from in-situ and laboratory tests, for use in mechanistic models for design of pavements affected by frost action. Plate-bearing tests were run on bituminous concrete pavements constructed directly on a silt subgrade, applying repeated loads to the pavement surface while the silt was frozen, thawing, thawed, and fully recovered. Repeated-load laboratory triaxial tests were performed on the silt in the same conditions. Analysis of deflection data from the in-situ tests showed resilient moduli of the silt as low as 2000 kPa for the critical thawing period, and 100,000 kPa or higher when silt was fully recovered. Analysis of the laboratory tests, which gave moduli comparable to the latter values, showed that resilient modulus during recovery from the thaw-weakened condition can be modeled as a function of the changing moisture content.

CR 78-24

PERFORMANCE OF THE ST. MARYS RIVER ICE BOOMS, 1976-77.

Perham, R.E., Sep. 1978, 13p., ADA-061 431, 5 refs.
33-1526
ICE BOOMS, ICE PRESSURE, ICE NAVIGATION, COLD WEATHER PERFORMANCE.

The ice booms on the St. Marys River at Sault Ste. Marie, Michigan and Ontario, were operated a second winter, 1967-77, under colder conditions, with less water flow, lower water levels, and 25% fewer ships in the river than during the previous year. The ice cover behind the booms remained frozen to shore for longer periods, and the loads registered in the booms were relatively unaffected by ship passages compared with the previous year's activity. As in the previous year, most structural load changes took place in the west ice boom and were due to movements of the ice cover immediately upstream of the boom. The cover broke free from shore on three occasions: the first and third occasions were minor events, but on the second occasion the cover cracked free, the timbers remained frozed to it, and the boom structure became damaged by the subsequent ice activity. Three anchor line assemblies broke over a period of about 4 hours; the two latter breaks occurred while a ship was operating in the ice. These events point out several factors to be considered in ice booms, such as designing the booms to withstand the action of the solid ice cover as well as the fragmented ice cover, keeping the structures and their assembly simple, and inspecting components and assemblies carefully.

CR 78-25

RIVER CHANNEL CHARACTERISTICS AT SELECTED ICE JAM SITES IN VERMONT.

Gatto, L.W., Oct. 1978, 52p., ADA-061 778, 30 refs.
33-1527
ICE JAMS, CHANNELS (WATERWAYS), REMOTE SENSING, PHOTOINTERPRETATION, TOPOGRAPHIC FEATURES, RIVER ICE.

The objectives of this investigation were to describe channel characteristics and geographic settings of ice jam sites from aerial photographic interpretation, to indicate which characteristics may be important in causing ice jams, and to suggest additional uses of aerial photographs. Uncontrolled photomosaics of each site were assembled and major river characteristics were delineated on the photomosaics. Characteristics described include: man-made structures, falls, rapids, changes in channel depths, channel islands, mid-channel shoals or bars, river bed material, river sinuosity, meanders, floodplain width, riparian vegetation, and types of development on the floodplain. River channel widths were measured from the photographs along rivers where ground truth data were available for comparison. Lengths of channel riffles and pools were measured along the rivers where variations in river depths were evident on the photographs. Aerial photographs provide a regional perspective for evaluating channel characteristics at an ice jam site and for analyzing the geographic setting at each site during ice-free conditions. Photographs taken after ice jams have formed are useful in monitoring ice jam formation, in analyzing ice characteristics, and in documenting ice jam breakup and movement.

CR 78-26

ICE FOG SUPPRESSION USING REINFORCED THIN CHEMICAL FILMS.

McFadden, T., et al, Nov. 1978, 23p., ADA-063 107, 20 refs.
Collins, C.M.
33-2526
ICE FOG, FOG DISPERSAL, CHEMICAL ICE PREVENTION.

Ice fog suppression experiments on the Fort Wainwright Power Plant cooling pond were conducted during the winters of 1974-76. Baseline information studies occupied a sizable portion of the available ice fog weather in 1974-75. Then hexadecanol was added to the pond and dramatically improved visibility by reducing fog generated from water vapor released by the pond at -14C. Although this temperature was not low enough to create ice fog, the cold vapor fog created was equally as devastating to visibility in the vicinity of the pond. During the winter of 1975-76, suppression tests were continued, using films of hexadecanol, mixes of hexadecanol and octadecanol, and ethylene glycol monobutyl ether (EGME). Suppression effectiveness at colder temperatures was studied and limits to the techniques were probed. A reinforcing grid was constructed that prevented breakup of the film by wind and water currents. Lifetime tests indicated the EGME degrades much more slowly than either hexadecanol or the hexadecanol-octadecanol mix. The films were found to be very effective fog reducers at warmer temperatures but still allowed 20% to 40% of normal evaporation to occur. The vapor thus produced was sufficient to create some ice fog at lower temperatures, but this ice fog occurred less frequently and was more quickly dispersed than the thick fog that was present before application of the films.

CR 78-27

EFFECT OF TEMPERATURE ON THE STRENGTH OF SNOW-ICE.

Haynes, F.D., Dec. 1978, 25p., ADA-067 583.
33-4414
SNOW STRENGTH, ICE STRENGTH, TEMPERATURE EFFECTS, TENSILE PROPERTIES, COMPRESSIVE STRENGTH.

Uniaxial compression and tension tests were conducted on polycrystalline snow-ice to determine the effect of temperature on its strength. Test temperatures ranged from -0.1C to -54C. Two machine speeds, 0.847 mm/s and 84.7 mm/s were used for the constant displacement rate tests. The compressive strength at -54C was about one order of magnitude higher than at -0.1C. The tensile strength at -18C was about 20% higher than at -0.1C. The initial tangent and 50% strength moduli are given for the compression tests, while the secant modulus to failure is given for the tension tests. The mode of fracture is discussed and the test results are compared with data from other investigations.

CR 78-28

TUNDRA DISTURBANCES AND RECOVERY FOLLOWING THE 1949 EXPLORATORY DRILLING, FISH CREEK, NORTHERN ALASKA.

Lawson, D.E., et al, Dec. 1978, 81p., ADA-065-192, 67 refs.
Brown, J., Everett, K.R., Johnson, A.W., Komárková, V., Murray, D.F., Webber, P.J.
33-2739
HUMAN FACTORS, ENVIRONMENTAL IMPACT, OIL SPILLS, DAMAGE, EXPLORATION, TUNDRA VEGETATION, REVEGETATION.

A 1949 drill site in the Naval Petroleum Reserve Number 4, Alaska, the Fish Creek Test Well 1, was examined in August 1977 to determine the disturbance caused by drilling activities and to analyze the response and recovery of the vegetation, soils, permafrost, and surficial materials to that disturbance. Man-made disturbances include bladed and unbladed vehicular trails, a winter runway, excavations, pilings, remains of camp structures, steel drums and other solid waste, and hydrocarbon spills. The most intense and lasting disturbance to the vegetation, soils, and permafrost resulted from bulldozing of surface materials, diesel fuel spills, and trails developed by multiple passes of vehicles. Thermokarst subsidence and thermal erosion, caused by increased thaw of permafrost due to disturbance, resulted in the development of a hummocky topography and water-filled depressions at the drill site. Some ice wedges disturbed in 1949 are still melting. Soil disturbance ranges from minor modification to complete destruction of the soil morphology. The effects of hydrocarbon spills are still detectable in the soils. Little of the original vegetation remains in the intensely disturbed area, such as around the drill pad where a grass-dominated community prevails. After 28 years, the vegetation cover is closed over most mesic sites, shallow wet sites are well vegetated, and xeric sites, areas of diesel fuel spills and areas of severe erosion remain mostly bare. Pioneering plant species on bare, disturbed areas are members of mature vegetation assemblages from the undisturbed tundra which have high reproductive and dispersal capacities. A hypothetical model of natural revegetation and vegetation recovery is proposed. Vascular plants, bryophytes, and lichens were collected from the Fish Creek site area for the first time. Recommendations on cleanup and restoration of sites are presented.

CR 79-01

STUDY OF WATER DRAINAGE FROM COLUMNS OF SNOW.

Denoth, A., et al, Jan. 1979, 19p., ADA-066 935.
Seidenbusch, W., Blumthaler, M., Kirchlechner, P., Ambach, W.
34-1108
SNOW, WATER FLOW, DRAINAGE.

Experiments were conducted to study the flow of water through columns of homogeneous, repacked snow. The gravity flow theory of water flow through snow was verified, although possibly there is some dependence of the relative permeability on the state of metamorphism of the snow. Also, at very large values of saturation there may be some additional flow in saturated channels.

CR 79-02

EFFECT OF WATER CONTENT ON THE COMPRESSIBILITY OF SNOW-WATER MIXTURES.

Abele, G., et al, Jan. 1979, 26p., ADA-066 936, 6 refs.
Haynes, F.D.
33-3650
SNOW WATER CONTENT, SNOW COMPRESSION, SNOW DENSITY, SNOW DEFORMATION.

The stress-density relationships of snow-water mixtures were investigated and are shown as functions of water content, initial snow density, initial snow-water mixture density and rate of deformation. An increase in water content in snow at a particular density or a decrease in the rate of deformation (or strain rate) decreases the stress, but apparently not the specific energy required to reach a specific mixture density.

CR 79-03

BLANK CORRECTIONS FOR ULTRATRACE ATOMIC ABSORPTION ANALYSIS.

Cragin, J.H., et al, Jan. 1979, 5p., ADA-066 979, 2 refs.
Quarry, S.T.
33-3166
WATER CHEMISTRY, CHEMICAL ANALYSIS, METALS, ATOMIC ABSORPTION.

Both flame and flameless atomic absorption(AA) measurements require a distilled water blank correction. This correction is due to the analyte contained in the distilled water used to prepare the standards and not, as commonly thought, to the reference "blank" used to zero the instrument. Flameless AA analyses of acidified heavy metal samples generally require additional corrections for the furnace deflection blank and for an acid blank. To prevent adsorption losses, the acid blank should be determined by extrapolation of a series of acid dilutions in distilled water.

CR 79-04

COMPUTER MODELING OF ATMOSPHERIC ICE ACCRETION.

Ackley, S.F., et al, Mar. 1979, 36p., ADA-068 582, 25 refs.
Templeton, M.K.
33-3651
ICE ACCRETION, METEOROLOGICAL FACTORS, ICE PHYSICS, HELICOPTERS.

A computer model is described to compute the amount of ice accretion on an object under a variety of initial conditions. Numerical techniques are best applied to these problems because of time dependent effects governing the amount of ice collected and the variety of initial conditions that can lead to ice accumulation. The helicopter rotor icing problem adds an additional complexity since the velocity along the rotor blade varies over a wide range, strongly affecting the amounts of ice collected at different blade positions. The physics of ice accretion is reviewed, and the accounting for the time-dependence in the computer model is described. Some model results are presented and indicate the dependence of ice accretion on velocity, droplet sizes, cloud liquid water content, and temperature for a cylindrical object of constant size.

CR 79-05

GROUTING SILT AND SAND AT LOW TEMPERATURES—A LABORATORY INVESTIGATION.

Johnson, R., Mar. 1979, 33p., ADA-068 741, 4 refs.
33-3867

LOW TEMPERATURE TESTS, GROUTING, CHEMICAL REACTIONS, COMPRESSIVE STRENGTH.

This report presents data from an experimental program undertaken to develop information on proposed and existing chemical grout solutions to provide engineering properties in connection with grouting of soils in ambient temperatures of 39 F and below. Twelve grout solutions were investigated, including organic chemicals, sodium silicates, cements, and clay (bentonite).

CR 79-06

NONDESTRUCTIVE TESTING OF IN-SERVICE HIGHWAY PAVEMENTS IN MAINE.

Smith, N., et al, Apr. 1979, 22p., ADA-069 817.
Eaton, R.A., Stubstad, J.
34-1843

ROADS, COLD WEATHER TESTS, PAVEMENTS, BEARING STRENGTH, FLEXURAL STRENGTH.

Nondestructive repetitive plate bearing (RPB) tests were conducted on various test sections in state highways in Maine during April 13-15, 1976. The RPB test consists of making resilient surface deflection measurements during repetitive loadings at various radii from the load plate. The pavement system stiffness was calculated, and the resilient modulus values for the various pavement layers were determined with the Chevron computer program for a layered elastic system. A thawed analysis using nondimensional deflection curves for the various sections provided a guide to the susceptibility of the pavement systems to surface failure and pothole development. Some comparisons between stabilized and nonstabilized aggregate and soil were made with calculated stiffness values. The moduli of the various materials were also compared. The residual surface deflections during testing for several pavement systems indicated a linear logarithmic relationship with number of load applications. A relationship between the modulus of the asphalt cement concrete pavement and pavement temperature was developed for the limited temperature range during the testing.

CR 79-07

PENETRATION TESTS IN SUBSEA PERMAFROST, PRUDHOE BAY, ALASKA.

Blouin, S.E., et al, May 1979, 45p., ADA-071 999, 9 refs.
Chamberlain, E.J., Sellmann, P.V., Garfield, D.E.
33-4437

SUBSEA PERMAFROST, BOTTOM SEDIMENT, PENETRATION TESTS, PENETROMETERS, OFFSHORE DRILLING.

Sediments beneath the Beaufort Sea near Prudhoe Bay, Alaska, were probed at 27 sites using a static cone penetrometer to determine engineering properties and distribution of material types, including ice-bonded sediments. The probe provided both point and casing resistance data and thermal profiles. At five sites these data were correlated with information from adjacent drilled and sampled holes. These control data and the quality of the probe information permitted profiles of sediment type and occurrence of ice-bonded material to be developed along three lines that included various geological features and depositional environments. Material properties were quite variable in the upper 14 m of sediments probed. In general, softer, finer-grained sediments occurred in the upper layers, while penetration refusal was met in stiff gravels 10 to 12 m below the seabed. Seabed temperatures during the study were all below OC. However, because of uncertainties in freezing point values caused by brines, evaluation of the penetration resistance data was required to identify the occurrence of ice-bonded sediments. The coupling of thermal and penetration resistance data revealed that seasonally ice-bonded sediments occurred where the sea ice froze back to or near the seabed. Deeper, perennially frozen sediments also appeared to be present at several probe sites. The penetration data obtained can be used to aid in the design of shallow and deep foundations in both ice-bonded and unfrozen subsea sediments.

CR 79-08

SEA ICE RIDGING OVER THE ALASKAN CONTINENTAL SHELF.

Tucker, W.B., et al, May 1979, 24p., ADA-070 572, 24 refs.
Weeks, W.F., Frank, M.
33-4223

SEA ICE DISTRIBUTION, PRESSURE RIDGES, ICE DEFORMATION, SURFACE ROUGHNESS, PROFILES, LASERS, MATHEMATICAL MODELS, STATISTICAL ANALYSIS, REMOTE SENSING, FORECASTING.

Sea ice ridging statistics obtained from a series of laser surface roughness profiles are examined. Each set of profiles consists of six 200-km-long flight tracks oriented approximately perpendicular to the coastline of the Chukchi and Beaufort Seas. The flights were made in February, April, August, and December 1976, and one additional profile was obtained north of Cross Island during March 1978. It was found that although there is a systematic variation in mean ridge height (h) with season (with the highest values occurring in late winter), there is no systematic spatial variation in h at a given time. The number of ridges/km is also high during the late winter, with the highest values occurring in the Barter and Cross Island profiles. In most profiles, the ice 20 to 60 km from the coast is more highly deformed than the ice either nearer the coast or farther seaward. The Wadhams model for the distribution of ridge heights gives better agreement with observed values in the higher ridge categories than does the Hibler model. Estimates of the spatial recurrence frequency of large pressure ridges are made by using the Wadhams model and also by using an extreme value approach. In the latter, the distribution of the largest ridges per 20 km of laser track was found to be essentially normal. Wadhams' distribution consistently predicts slightly larger ridge sails than does the extreme value approach.

CR 79-09

SEDIMENTOLOGICAL ANALYSIS OF THE WESTERN TERMINUS REGION OF THE MATANUSKA GLACIER, ALASKA.

Lawson, D.E., May 1979, 112p., ADA-072 000, Refs. p.109-112.
33-4438

GLACIAL DEPOSITS, GLACIAL GEOLOGY, SEDIMENT TRANSPORT, GLACIAL TILL.

Sedimentation at the terminus of the Matanuska Glacier has been found to be primarily subaerial in a 100- to 300-m wide, ice-cored zone paralleling the edge of the active ice. Certain physical and chemical characteristics of the ice and debris of the superglacial, englacial and basal zones of the glacier indicate the debris of the basal zone, the primary source of sediment, is entrained during freeze-on of meltwater to the glacier sole. Till formation results from the melting of buried ice of the basal zone. Melt-out till inherits the texture and particle orientations of basal ice debris; other properties are not as well preserved. Most deposits result from resedimentation of till and debris by sediment gravity flows, meltwater sheet and rill flow, slump, spall, and ice ablation. Depositional processes are interrelated in the process of backwasting of ice-cored slopes. Sediment flows are the primary process of resedimentation. Their physical characteristics, multiple mechanisms of flow and deposition, and characteristics of their deposits vary with the water content of the flow mass. Deposits of each process are distinguished from one another by detailed analysis of their internal organization, geometry and dimensions, and the presence of other internal and related external features. Genetic facies are defined by these characteristics.

CR 79-10

ULTRASONIC VELOCITY INVESTIGATIONS OF CRYSTAL ANISOTROPY IN DEEP ICE CORES FROM ANTARCTICA.

Kohnen, H., et al, May 1979, 16p., ADA-071 451, 23 refs.
Gow, A.J.
33-4204

ICE SHEETS, GLACIER FLOW, ICE CORES, ICE CRYSTAL STRUCTURE, ICE ACOUSTICS, ANISOTROPY, WAVE PROPAGATION, ULTRASONIC TESTS, ICE CRYSTAL SIZE, SHEAR PROPERTIES, ANTARCTICA—BYRD STATION, ANTARCTICA—LITTLE AMERICA STATION.

Ice cores from Byrd Station and Little America V have been used to test an ultrasonic technique for evaluating crystal anisotropy in the Antarctic Ice Sheet. P-wave velocities measured parallel and perpendicular to the vertical axes of cores from the 2164-m-thick ice sheet at Byrd Station have yielded results in excellent agreement with the observed c-axis fabric profile and with the in-situ P-wave velocity profile measured parallel to the bore hole axis. Velocity differences in excess of 140 m/s for core samples from deeper than 1300 m attest to the strong single pole clustering of crystallographic c-axes about the vertical especially in the zone from 1300-1800 m. Such oriented structure is compatible only with strong horizontal shearing in the zone. The existence in an ice sheet of widespread shearing several hundred meters above its bed raises serious questions as to the validity of current concepts of the flow of large ice masses that tend to gloss over or ignore crystal alignments of this magnitude. The ultrasonic technique has proven to be a fast and powerful tool for determining crystal fabrics in ice sheets. Results from Byrd Station and Little America V, together with fabric data from several other locations in East Antarctica, suggest that crystal orientations within the Antarctic Ice Sheet tend to be characterized by either single or multi-pole clustering of c-axes about a vertical symmetry axis.

CR 79-11

SNOWPACK OPTICAL PROPERTIES IN THE INFRARED.

Berger, R.H., May 1979, 16p., ADA-071 004.
34-1366

SNOW OPTICS, SNOW DENSITY, LIGHT SCATTERING, REFLECTIVITY.

A theory of the optical properties of snow in the 2-20 microns region of the infrared has been developed. Using this theory, it is possible to predict the absorption and scattering coefficients and the emissivity of snow, as function of the snow parameters of grain size and density, for densities between 0.17 and 0.4 g/cu. cm. The absorption and scattering coefficients are linearly related to the density and inversely related to the average grain size. The emissivity is independent of grain size and exhibits only a weak dependence upon density.

CR 79-12

POINT SOURCE BUBBLER SYSTEMS TO SUPPRESS ICE.

Aahton, G.D., May 1979, 12p., ADA-071 038, 8 refs.
33-4224

ICE REMOVAL, BUBBLES, ICE MELTING, HEAT TRANSFER, WATER FLOW, AIR TEMPERATURE, PILES, OFFSHORE STRUCTURES, COMPUTERIZED SIMULATION.

An analysis of a point source bubbler system used to induce local melting of an ice cover is presented. The analysis leads to a numerical simulation programmed in FORTRAN which may be used to predict the effectiveness of such systems. An example application is presented using a typical record of average daily air temperatures. The FORTRAN program for the point source simulation as well as a FORTRAN program for line source systems are included in the Appendix.

CR 79-13

TURBULENT HEAT TRANSFER IN LARGE ASPECT CHANNELS.

Haynes, F.D., et al, May 1979, 5p., ADA-071 003, 6 refs.
Aahton, G.D.
33-4136

HEAT TRANSFER, CHANNELS (WATERWAYS), ICE WATER INTERFACE, TURBULENT FLOW, RIVER FLOW, ICE COVER EFFECT, MATHEMATICAL MODELS, WATER TEMPERATURE.

Heat transfer in turbulent flow was measured in a rectangular channel with a width of 0.254 m and a flow depth of 0.0254 m. Correlations between the Nusselt and Reynolds numbers are given for a range of 3.02x1000 is less than Re is less than 2.236x10,000. A Prandtl number range of 9.90 is less than or equal to 12.28 for water was used in the tests. The results are compared with those of other investigations and show that some well-known correlations underpredict the heat transfer by about 35%.

CR 79-14

ACCELERATED ICE GROWTH IN RIVERS.

Calkins, D.J., May 1979, 5p., ADA-071 015, 5 refs.
33-4137

FRAZIL ICE, RIVER ICE, ICE GROWTH, ICE COVER THICKNESS, HEAT TRANSFER, SLUSH, POROSITY, MATHEMATICAL MODELS.

Solid ice growth rates due to the presence of frazil slush beneath the ice cover have been shown to be greater than the so-called static growth. The frazil slush reduces the effective heat of ice solidification and the frazil particles freeze into the interstitial water. Numerical schemes are presented which clearly show the effect of frazil ice porosity on ice cover growth rates and the numerical model using air temperature as the major input is compared with field data on ice thickness in a small river laden with frazil ice beneath its cover.

CR 79-15

DETECTION OF ARCTIC WATER SUPPLIES WITH GEOPHYSICAL TECHNIQUES.

Arcone, S.A., et al, June 1979, 30p., ADA-072 157, 38 refs.
Delaney, A.J., Sellmann, P.V.
33-4423

WATER SUPPLY, DETECTION, GROUND WATER, MAGNETIC PROPERTIES, RADIO WAVES.

This report discusses the application of several modern geophysical techniques to groundwater exploration in areas of permafrost. These methods utilize the principles of magnetic induction and radiowave surface impedance in the 10- to 400 kHz band, the techniques of impulse and side-looking radar in the 50- to 10,000 MHz band, and also some optical techniques using imagery obtained from a satellite, all for detecting free water under an ice cover in shallow, almost completely frozen lake basins, and thaw zones within lake beds, stream channels, and in permafrost in general. The radar studies demonstrate the use of these techniques for determining depth of free water and ice cover thickness on lakes and rivers.

CR 79-16

CONSTRUCTION AND PERFORMANCE OF MEMBRANE ENCAPSULATED SOIL LAYERS IN ALASKA.

Smith, N., June 1979, 27p., ADA-073 531, 17 refs.
34-134

SOIL FREEZING, COLD WEATHER TESTS, FROST PROTECTION, SOIL WATER, WATERPROOFING, FROST HEAVE.

In 1973 two membrane encapsulated soil layer (MESL) test sections were constructed into existing gravel surfaced roads at Elmendorf AFB and at Ft. Wainwright in Anchorage and Fairbanks, Alaska, respectively. The Elmendorf AFB MESL contains a silty clay soil and the Ft. Wainwright MESL contains a nonplastic silt. Both sections were constructed at soil moisture contents of approximately 2% to 3% below optimum for the CE-12 compactive effort. There were no indications of soil moisture migration during freezing in either test section, and after-thaw field California Bearing Ratio values were nearly equal to values measured before freezing. There is growing evidence of a slight increase in the overall soil moisture content in the Elmendorf AFB MESL, possibly from moisture entering through the single layer polyethylene sidewalls which were not treated with asphalt emulsion. There is good evidence that the membrane of the same section might have received damage during a soil sampling operation which allowed localized moisture infiltration. A two-layer polyethylene membrane used in the Ft. Wainwright MESL is considered a more positive moisture barrier than the single sheet and a justifiable added cost for permanent construction.

CR 79-17

ROOF RESPONSE TO ICING CONDITIONS.

Lane, J.W., et al, July 1979, 40p., ADA-074 477, 12 refs.

Marshall, S.J., Munis, R.H.

34-625

ROOFS, THERMAL CONDUCTIVITY, ICING, MELTING, SLOPE ORIENTATION.

Six test roofs of two different slopes—16.3 deg and 39.8 deg, and three different roof coverings—asphalt shingles, cedar shingles, and corrugated aluminum sheeting, were constructed at USACRREL, Hanover, New Hampshire, and were instrumented with thermocouples, heat flow meters, and calibrated gutters. Measurements were recorded for the winters of 1971-72 and 1972-73. The degree of icing and the chronological changes in the snow cover were recorded on 35-mm Kodachrome slides. It was found that eave icing is a sensitive function of the slope, roof covering composition, and solar radiation. The effects of wind were not investigated; the data were screened to remove all information corresponding to windspeeds over 8 km/h. In order of increasing tendency to form ice dams on the eaves, the roofs were high-slope asphalt, high-slope cedar, high-slope aluminum, low-slope asphalt, low-slope cedar, and low-slope aluminum.

CR 79-18

INSULATING AND LOAD-SUPPORTING PROPERTIES OF SULFUR FOAM FOR EXPEDIENT ROADS IN COLD REGIONS.

Smith, N., et al, Sep. 1979, 21p., ADA-074 694, 6 refs.

Pazsint, D.A.

34-742

ROADS, THERMAL INSULATION, CELLULAR MATERIALS, BEARING STRENGTH, FREEZE THAW CYCLES.

Temperatures of the subgrade and of sulfur foam insulation test sections in an expedient road were monitored with thermocouples to document freezing and thawing conditions. Vehicular trafficking was conducted on a limited basis to determine the load supporting capabilities of the foam. The sulfur foam, placed directly under a prefabricated surface mat, was found to be unsuitable for use as an expedient thermal insulation and traffic load supporting material, primarily because of its low tensile strength and high brittleness. The insulating value of sulfur foam produced by the batch process in the field was about one-half that of extruded polystyrene, meaning double the thickness for equal protection against thaw.

CR 79-19

CRITICAL VELOCITIES OF A FLOATING ICE PLATE SUBJECTED TO IN-PLANE FORCES AND A MOVING LOAD.

Kerr, A.D., Aug. 1979, 12p., ADA-075 455, 6 refs.

34-802

FLOATING ICE, DYNAMIC LOADS, VELOCITY.

The critical velocities of loads moving over floating ice plates have been determined by several authors. In all these analyses it was assumed that the in-plane force field in the ice cover is zero. However, due to constrained thermal strains, in-plane forces do occur in the field. The purpose of the present paper is to determine their effect upon the critical velocities of the moving loads. It is shown that a uniform compression force field reduces the critical velocity, whereas a tension force has the opposite effect.

CR 79-20

VOLUMETRIC CONSTITUTIVE LAW FOR SNOW SUBJECTED TO LARGE STRAINS AND STRAIN RATES.

Brown, R.L., Aug. 1979, 13p., ADA-075 474, 10 refs.

34-913

SNOW DEFORMATION, SNOW COMPRESSION, VOLUME, STRAINS, STRAIN TESTS, DYNAMIC LOADS, TRACKED VEHICLES.

A volumetric constitutive equation was developed to characterize the behavior of snow subjected to large compressive volumetric deformations. By treating the material as a suspension of air voids in a matrix material of polycrystalline ice, a rate-dependent volumetric constitutive law was formulated and found to accurately predict material response to pressure loads for a wide range of load rates. Comparison of the theory with shock wave data was not considered in this paper, although the constitutive law appears to be valid for such load situations. One application to oversnow mobility of tracked vehicles was made. In this case, power requirements due to snow compaction were calculated parametrically in terms of vehicle speed, track loading, and snow density.

CR 79-21

TOWING SHIPS THROUGH ICE-CLOGGED CHANNELS BY WARPING AND KEDGING.

Mellor, M., Sep. 1979, 21p., ADA-077 801, 6 refs.

34-1380

CHANNELS (WATERWAYS), ICE COVER, ICE PRESSURE, SHIPS, ANCHORS.

The report studies the question of whether Great Lakes freighters could move effectively through ice-clogged channels with the aid of tows provided by warping or kedging systems. Ten operational concepts are outlined, and their advantages and disadvantages are noted. The crushing resistance of floating brash ice is then analyzed. The neutral, active and passive states of stress for laterally confined brash ice are considered, and the resistance to horizontal thrusting by a smooth vertical wall is calculated for cohesionless brash ice, and for ice in which there is finite cohesion between the ice fragments. The thickening of the ice cover in the vicinity of a "pusher" and the formation of pressure ridges are analyzed in order to estimate the amount of pile-up that can occur against a ship hull. The analysis then moves on to consideration of ship resistance by brash ice, taking into account crushing resistance at the bow, tangential friction at the bow, and the hull friction aft of the bow section. Comparisons are made between thrust from the ship's screws and the calculated ice resistance. The next section of the report estimates the force requirements for a warping or kedging system in terms of thrust augmentation for existing vessels. Tow cable requirements are given, and estimates are made for cable anchors and for anchorage of underwater structures. The force and power requirements for winches and windlasses are given, the practical problems involved in the pickup or transfer of cables are mentioned, and the report concludes with a brief appraisal. The conclusion is that a simple warping tug system is appropriate for a full-scale experiment, a chain ferry with auxiliary barge seems attractive for an operational system, and a chain ferry plow may be an efficient way to clear ice from channels.

CR 79-22

CRYSTAL ALIGNMENTS IN THE FAST ICE OF ARCTIC ALASKA.

Weeks, W.F., et al, Oct. 1979, 21p., ADA-077 188, 9 refs.

Gow, A.J.

34-1379

ICE CRYSTAL STRUCTURE, FAST ICE, ICE CRYSTAL GROWTH, SEA ICE, OCEAN CURRENTS.

Field observations at 60 sites located in the fast or near-fast ice along a 1200-km stretch of the north coast of Alaska between Bering Strait and Barter Island have shown that 95% of the ice samples exhibit striking c-axis alignments within the horizontal plane. Such alignments were usually well developed by the time the ice was 50 cm thick and in some cases when the ice was 20 cm thick. In all cases the degree of preferred orientation increased with depth in the ice. Representative standard deviations around a mean direction in the horizontal plane are commonly less than 10 deg for samples collected near the bottom of the ice. The general patterns of the alignments support a correlation between the preferred c-axis direction and the current direction at the ice/water interface. A comparison between c-axis alignments and spot current measurements made at 42 locations shows that the most frequent current direction coincides with the mean c-axis direction. Such alignments are believed to be the result of geometric selection with the most favored orientation being that in which the current flows normal to the (0001) plates of ice that compose the dendritic sea ice/sea water interface.

CR 79-23

EFFECTS OF SEASONAL CHANGES AND GROUND ICE ON ELECTROMAGNETIC SURVEYS OF PERMAFROST.

Arcone, S.A., et al, Oct. 1979, 24p., ADA-077 903.

Delaney, A.J., Sellmann, P.V.

34-2363

PERMAFROST DISTRIBUTION, ELECTROMAGNETIC PROSPECTING, SEASONAL VARIATIONS, GROUND ICE.

The performance of surface impedance and magnetic induction electromagnetic subsurface exploration techniques was studied seasonally at various sites in Alaska where permafrost and massive ground ice occurred. The methods used have greatest sensitivity within about 20 m of the surface and are, therefore, most applicable for shallow subsurface investigations. The selection of study sites was based on anticipated contrasts in electrical resistivity between ground ice and adjacent earth materials. A magnetic induction instrument, using a separation of 3.66-m between the transmitter and receiver antennas, in general was able to detect near-surface zones of massive ice and to provide data regarding permafrost distribution in both the Fairbanks and Prudhoe Bay areas.

CR 79-24

ANTIFREEZE-THERMODRILLING FOR CORE THROUGH THE CENTRAL PART OF THE ROSS ICE SHELF (J-9 CAMP), ANTARCTICA.

Zotikov, I.A., Nov. 1979, 12p., ADA-078 748, 11 refs.

34-1577

ICE SHELVES, ICE CORES, DRILL CORE ANALYSIS.

By using a new thermocoring technique, a hole was successfully drilled through the 416-m thickness of the Ross Ice Shelf at J-9 Camp. This report provides a description of the drill and an account of this drilling project. A provisional examination of the core shows the ice shelf to consist of 410 m of snow and glacial ice underlain by 6 m of sea ice formed by direct freezing of sea water to the bottom of the Ross Ice Shelf. (Auth.)

CR 79-25

CHARGED DISLOCATION IN ICE: 1. EXISTENCE AND CHARGE DENSITY MEASUREMENT BY X-RAY TOPOGRAPHY.

Itagaki, K., Nov. 1979, 12p., ADA-078 775, 23 refs.

34-1608

ICE ELECTRICAL PROPERTIES, ELECTRIC CHARGE, DISLOCATIONS (MATERIALS), X RAY ANALYSIS, ICE CRYSTAL STRUCTURE.

The motion of dislocations in single crystal ice under an electric field was observed by using X-ray topographic methods. Electric charge density on these dislocations was deduced from the amplitude and length of the dislocation segment under the known AC electrical field. In linear charge density, considerable variation is possible, depending on the effective field acting on the dislocation lines.

CR 79-26

LAKE CHAMPLAIN ICE FORMATION AND ICE FREE DATES AND PREDICTIONS FROM METEOROLOGICAL INDICATORS.

Bates, R.E., et al, Nov. 1979, 21p., ADA-079 640, 11 refs.

Brown, M.-L.

34-1745

LAKE ICE, ICE FORMATION, ICE BREAKUP, METEOROLOGICAL DATA, PERIODIC VARIATIONS.

A 19-yr record of the annual closing and opening dates of operation of the Lake Champlain ferry at Grand Isle, Vermont, which are controlled by the lake's ice cover, was made available to CRREL. These navigation records accurately approximated the freeze-over and breakup dates for the ferry crossing area between Gordon Landing, Vermont, and Cumberland Head, New York. When compared statistically with water temperature and climatological data for the same years at nearby Lake Champlain locations, the dates allowed accurate predictions of ice formation. From nearby air temperature records, cumulative freezing degree-day (C) curves were plotted for each year of record, and ice formation dates and standard deviations were predicted with considerable accuracy. Several methods of predicting ice formation on Lake Champlain were attempted. The most accurate approach used a combination of water temperatures and freezing degree-days. The influence of wind speed on ice cover formation and prediction are also discussed in the report.

CR 79-27

SOME BESSEL FUNCTION IDENTITIES ARISING IN ICE MECHANICS PROBLEMS.

Takagi, S., Nov. 1979, 13p., ADA-078 709, 10 refs.

34-1609

ICE MECHANICS, ANALYSIS (MATHEMATICS).

Some Bessel function identities found by solving problems of the deflection of a floating ice plate by two different methods are rigorously proved. The master formulas from which all the identities are derived are in a Fourier reciprocal relationship, connecting a Hankel function to an exponential function. Many new formulas can be derived from the master formulas. The analytical method presented here now opens the way to study a hitherto impossible type of problem-the deflection of floating elastic plates of various shapes and boundary conditions.

CR 79-28

ELECTRON MICROSCOPE INVESTIGATIONS OF FROZEN AND UNFROZEN BENTONITE.

Kumai, M., Nov. 1979, 14p., ADA-078 776, 12 refs.

34-1578

ELECTRON MICROSCOPY, FROZEN GROUND PHYSICS, SOIL STRUCTURE, CLAY SOILS.

Transmission and scanning electron micrographs of Umiat bentonite revealed thin, mica-like grains with irregular shapes. Most of the bentonite showed electron diffraction ring patterns, but some showed hexagonal net patterns as well as ring patterns. The lengths of the unit cells were calculated to be 5.18 Å along the a-axis and 8.97 Å along the b-axis. Semiquantitative analyses were made using an energy dispersive spectrometer. Common elements such as Si, Ti, Al, Fe, Mg, Na and K were determined. The molecular ratio of SiO_2-:Al_2O_3 was calculated to be 492:100 for the bulk sample, indicating that Umiat bentonite is similar in most respects to Wyoming bentonite, and is classified as a montmorillonite. The microstructure of frozen Umiat bentonite was observed at a specimen temperature of -100C using a scanning electron microscope equipped with a cold stage. Frozen bentonite and segregated ice patterns formed from wet bentonite were examined using an X-ray map and Si X-ray line scan. Sublimation processes of ice in the frozen bentonite were observed at specimen temperatures of -60 and -80C. After sublimation of the ice, the bentonite displayed a honeycomb structure. It was concluded that the freezing-sublimation cycle in frozen soil increases the permeability of water vapor due to the three-dimensional structure of the coagulated clay formed by freezing.

CR 79-29

ANALYSIS OF PLASTIC SHOCK WAVES IN SNOW.

Brown, R.L., 1979, 14p., ADA-080 051, 12 refs.

34-2528

WAVE PROPAGATION, SNOW DEFORMATION, SHOCK WAVES, LOADS (FORCES), ANALYSIS (MATHEMATICS).

An analytical study of the propagation of shock waves in snow was carried out to evaluate the response of medium density snow to high rates of loading. One solution was developed for steady shock waves; this resulted in calculation of pressure jump, density jump and stress wave speed. Correlation with available experimental data was found to be good. Nonsteady shock waves were also considered in order to evaluate wave attenuation rates in snow. Very few data were available to compare with the analytical results, so no definite conclusions on the part of the study could be made. The results show, however, that shock waves that produce plastic deformation attenuate at extremely high rates and that differences in pressure between two waves are quickly eliminated within a short distance. Calculations were also made to evaluate the effect of wave frequency on attenuation rates. The results show that, for plastic waves, frequency is not a predominant factor for determining attenuation rates. (Auth.)

CR 79-30

SUPPRESSION OF RIVER ICE BY THERMAL EFFLUENTS.

Ashton, G.D., Dec. 1979, 23p., ADA-080 654, 5 refs.

34-2283

RIVER ICE, ICE CONTROL, THERMAL DIFFUSION, THERMAL POLLUTION, HEAT TRANSFER.

The ice suppression resulting from discharge of warm water into rivers during winter is analyzed with emphasis on two different cases. In Part 1, the case of a thermal effluent fully mixed across the flow section is analyzed to include the effects of unsteadiness in the effluent temperature and the meteorological variations. The location of the ice edge is determined either by O C water temperature criterion or an equilibrium ice melting analysis. The choice of the applicable criterion emerges naturally from the analysis, even though the location of the ice edge may be considerably different when a steady-state analysis is done. In Part 2, the case of a side discharge of heated effluent is analyzed, also in an unsteady manner, and the effects of transverse dispersion are included in the analysis. Comparisons are made in Parts 1 and 2 to limited field data that are available.

CR 80-01

IMPROVED ENZYME KINETIC MODEL FOR NITRIFICATION IN SOILS AMENDED WITH AMMONIUM. 1. LITERATURE REVIEW.

Leggett, D.C., et al, Jan. 1980, 20p., ADA-082 303, Refs. p.18-20.

Iskandar, I.K.

35-2583

WASTE TREATMENT, WATER TREATMENT, SOIL CHEMISTRY, SOIL MICROBIOLOGY, GROWTH.

Previous research indicates that nitrification in pure cultures can be represented by Michaelis-Menten kinetics. However, the effects of temperature and especially pH have not been treated systematically in any of the previous reviews of the subject. The work reported here is an attempt to synthesize reported temperature and pH effects on nitrification and nitrifier growth rates. In addition we attempt to extend the principles of microbial kinetics to soils. Our work indicates that pH effects can be interpreted mechanistically as inhibitions by hydrogen and hydroxyl ions, nitrous acid, and ammonia. These are incorporated into the Michaelis-Menten expressions. It is also our observation that ammonium oxidizers in natural habitats are characterized by lower Michaelis constants than pure cultures. This is significant particularly in terms of their growth and activity in acid soils. Alternatively, we speculate that proliferation of ammonium oxidizers in acid soils is due to spatial heterogeneity of "pH" at the microsite level.

CR 80-02

WINTER THERMAL STRUCTURE, ICE CONDITIONS AND CLIMATE OF LAKE CHAMPLAIN.

Bates, R.E., Jan. 1980, 26p., ADA-082 304, 7 refs.

35-2585

LAKE ICE, ICE CONDITIONS, THERMAL REGIME, ICE FORMATION, ICE THERMAL PROPERTIES, WATER TEMPERATURE, METEOROLOGICAL DATA, WINTER, THERMISTORS, STEFAN PROBLEM.

Winter thermal structure and ice conditions in the land-fast ice cover of Lake Champlain were studied in detail for the winters of 1975-76 and 1976-77. The lake was instrumented to a depth of 9.5 m with a string of highly calibrated thermistors attached to an ice mooring system and connected to a data logger at Shelburne Point, Vermont, during the winter of 1975-76 and at Gordon Landing on Grand Isle, Vermont, during 1976-77. This data logger automatically recorded water temperatures from the surface of the lake through snow, ice and water vertical profiles to the bottom of the lake every four hours. Pertinent meteorological parameters are presented for the appropriate measurement sites during the two winter periods, November '75-April '76, and November '76-April '77. Computations were made of freezing degree days for both winters and correlated with ice formation dates. Predictions of ice growth, using the Stefan equation with an empirical coefficient, were correlated with actual ice growth. Documentation was made of the Lake Champlain Transportation Company's first attempt at wintertime navigation by ferry from Gordon Landing, Vermont, to Cumberland Head, New York, in a land fast ice cover during one of the coldest winters of this century.

CR 80-03

REVEGETATION AT TWO CONSTRUCTION SITES IN NEW HAMPSHIRE AND ALASKA.

Palazzo, A.J., et al, Jan. 1980, 21p., ADA-082 305, 30 refs.

Rindge, S.D., Gaskin, D.A.

35-2586

REVEGETATION, SEWAGE DISPOSAL, LAND RECLAMATION, GRASSES, GRAVEL, ORGANIC SOILS, SLUDGES, NUTRIENT CYCLE.

Revegetation techniques were investigated for gravel soils in cold regions. Two gravel soil test sites were established in Hanover, New Hampshire, and Fairbanks, Alaska. During three growing seasons, we studied the applicability and cost effectiveness of various nutrient sources and mulch materials. The nutrient sources included sewage sludge (40, 60 and 80 tons/acre) and commercial fertilizer (at 200, 400 and 600 lb/acre). The mulching materials were wood fiber mulch with various types of tackifiers, peat moss, and sewage sludge. The effects of refertilization during the second growing season were also studied.

CR 80-04

ENVIRONMENTAL ANALYSIS OF THE UPPER SUSITNA RIVER BASIN USING LANDSAT IMAGERY.

Gatto, L.W., et al, Jan. 1980, 41p., ADA-084 900, 52 refs.

Merry, C.J., McKim, H.L., Lawson, D.E.

34-3198

AERIAL SURVEYS, REMOTE SENSING, SPACEBORNE PHOTOGRAPHY, LANDSAT, MAPPING, PHOTOINTERPRETATION, SPACECRAFT, RIVER BASINS, ENVIRONMENTS, UNITED STATES—ALASKA—SUSITNA RIVER.

The primary objectives of this study were to 1) prepare a map from Landsat imagery of the Upper Susitna River Basin drainage network, lakes, glaciers and snowfields, 2) identify possible faults and lineaments within the upper basin and within a 100-km radius of the proposed Devil Canyon and Watana dam sites as observed on Landsat imagery, and 3) prepare a Landsat-derived map showing the distribution of surficial geologic materials and poorly drained areas. The EROS Digital Image Enhancement System (EDIES) provided computer-enhanced images of Landsat-1 scene 5470-19560. The EDIES false color composite of this scene was used as the base for mapping drainage network, lakes, glaciers and snowfields, six surficial geologic materials units and poorly drained areas. Some single-band and other color composites of Landsat images were used during interpretation. All the above maps were prepared by photointerpretation of Landsat images without using computer analysis, aerial photographs, field data, or published reports.

CR 80-05

ASPHALT CONCRETE FOR COLD REGIONS; A COMPARATIVE LABORATORY STUDY AND ANALYSIS OF MIXTURES CONTAINING SOFT AND HARD GRADES OF ASPHALT CEMENT.

Dempsey, B.J., et al, Jan. 1980, 55p., ADA-082 198, 39 refs.

Ingersoll, J., Johnson, T.C., Shahin, M.Y.

35-2587

BITUMENS, BITUMINOUS CONCRETES, PAVEMENTS, CEMENT ADMIXTURES, TENSILE PROPERTIES, CRACKING (FRACTURING), STRAIN TESTS, THERMAL EFFECTS, VISCOSITY, TRAFFICABILITY.

Pavements containing soft asphalt cement have been shown in the past to be less susceptible to low-temperature contraction cracking, but more susceptible to traffic-load-associated distress in warm weather, than pavements with harder asphalt cements. This research comprised laboratory testing to determine the properties of asphalt-aggregate mixtures containing three grades of asphalt cements, and analyses to project the performance of pavements containing each of the asphalts, in resisting thermally induced distress and traffic-associated distress. From the results it is concluded that only the softest asphalt cement tested (AC 2.5) would perform satisfactorily in a cold climatic zone. The moderately soft (AC 5) and moderately hard (AC 20) asphalt cements showed little susceptibility to thermal cracking in a moderate and a warm climatic zone respectively. The AC 2.5 and AC 5 asphalts are not recommended for use in warm climates, however, owing to increased susceptibility to rutting under traffic.

CR 80-06

MAXIMUM THICKNESS AND SUBSEQUENT DECAY OF LAKE, RIVER AND FAST SEA ICE IN CANADA AND ALASKA.

Bilello, M.A., Feb. 1980, 160p., ADA-084 488, 57 refs.

35-2588

ICE COVER THICKNESS, ICE MELTING, ICE DETERIORATION, LAKE ICE, RIVER ICE, SEA ICE, FAST ICE, AIR TEMPERATURE, ICE FORECASTING.

Weekly measurements of the thickness of lake, river and fast sea ice made over a period of 10 to 15 years at 66 locations in Canada and Alaska are analyzed, and the portion of the data relating to maximum ice thickness and decay (i.e. the decrease in ice thickness) is examined. Ice thickness curves revealed individual patterns of ice decay, and comparisons between locations disclosed major contrasts in the amount of ice accretion and the times of maximum ice and ice clearance. Although many factors affect the ice decay process, this study investigates in detail the effect of thawing temperatures. Concurrent measurements of the air temperature at each location made it possible to analyze the relationship between accumulated thawing degree-days (ATDD) and ice cover decay. Other factors affecting ice ablation and break-up, such as snow-ice formation, snow cover depth, solar radiation and wind are also discussed.

CR 80-07

WASTEWATER TREATMENT IN COLD REGIONS BY OVERLAND FLOW.

Martel, C.J., et al, Feb. 1980, 14p., ADA-084 489, 16 refs.

Jenkins, T.F., Palazzo, A.J.

34-3325

WASTE TREATMENT, WATER TREATMENT, IRRIGATION, COLD WEATHER PERFORMANCE, ENGINEERING, SOIL CHEMISTRY, AGRICULTURE.

Primary effluent, secondary effluent (package extended aeration plant effluent with BOD's often greater than 30 mg/liter) and tapwater were applied to separate sections of a pilot-scale overland flow site in a cold regions environment. The average application rate for each section was 5.0 cm (2.0 in.) per week. Performance was evaluated for one year, May 1977 to June 1978. Results of this study demonstrated that overland flow can renovate both primary and secondary effluent during spring, summer and fall seasons. However, during winter, runoff water quality from the primary section contained almost no pollutants during its entire operation. Ammonia was the easiest form of nitrogen to remove and nitrate was the most difficult. Rainstorms did not cause a "flushing" effect. However, ammonia and nitrate concentrations in the runoff increased during snowmelt. The forage yield from the primary and secondary sections was almost twice that of a typical New Hampshire hayfield. Wastewater application during winter caused only minor cases of plant injury. Based on these results, a minimum of 30 days of storage is recommended if overland flow is used as a polishing process. If overland flow is used to treat primary effluent, the number of storage days predicted by EPA-1 computer program appears to be adequate.

CR 80-08

ANALYSIS OF THE PERFORMANCE OF A 140-FOOT GREAT LAKES ICEBREAKER: USCGC *KATMAI BAY*.

Vance, G.P., Feb. 1980, 28p., ADA-084 736, 8 refs.

34-3199

ICEBREAKERS, BUBBLES, PROTECTIVE COATINGS, ICE COVER THICKNESS, ICE FRICTION, ICE STRENGTH.

This report presents the results of the tests on the new U.S. Coast Guard 140-ft icebreaker Katmai Bay (WTGB-101) in the level plate ice and brash ice in Whitefish Bay and the St. Marys River. The results indicate that the vessel can penetrate 22 in. of level freshwater ice with 2-3 in. of snow cover. It can also penetrate up to 48 in. of brash ice in a continuous mode and at least 30 in. of plate ice by backing and ramming. The installed bubbler system decreased the required power of the vessel from 10 to 30% in brash ice and 25 to 35% in level ice. The low friction coating appears to be effective in decreasing the friction factor when it remains intact; when it peels off, it appears to make conditions worse than plain paint. An average dynamic friction factor of 0.15 could be used over the entire hull for these tests.

CR 80-09

HIGH-EXPLOSIVE CRATERING IN FROZEN AND UNFROZEN SOILS IN ALASKA.

Smith, N., Feb. 1980, 21p., ADA-084 702, 8 refs.

34-3326

FROZEN GROUND MECHANICS, EXPLOSION EFFECTS, SEASONAL FREEZE THAW, TALIKS, EXCAVATION, TESTS.

Explosive cratering tests were conducted in seasonally frozen and thawed gravel at Ft. Richardson near Anchorage, Alaska, and in seasonally frozen and thawed silt overlying permafrost and in silt permafrost at Ft. Wainwright near Fairbanks, Alaska. Explosive charge weights ranged from 26 to 3120 lb, and charge burial depths ranged from about 3 to 40 ft. The cube root of the charge weight scaling was used to determine maximum scaled crater dimensions and optimum scaled depth of burial of the charge. Test results for frozen and thawed gravel were essentially the same because of the low moisture content and the relatively shallow depth of freezing (5 to 6 ft). The optimum depth of burial of the charge for maximizing the apparent radius and depth and the true radius was about 1.8 times the cube root of the charge weight for both the frozen and thawed conditions. In seasonally frozen silt overlying a talik and silt permafrost, the maximum scaled crater dimensions and optimum scaled burial depths of the charge were smaller than for the thawed condition except for the true crater dimensions. The channeling of energy in the talik produces maximum crater dimensions and an optimum burial depth for the true crater that is larger than for the thawed condition. The results for the homogeneous silt permafrost were very similar to the frozen gravel results, with much smaller maximum crater dimensions and smaller optimum charge burial depths than for the thawed silt overlying permafrost.

CR 80-10
MATHEMATICAL MODEL TO CORRELATE FROST HEAVE OF PAVEMENTS WITH LABORATORY PREDICTIONS.

Berg, R.L., et al, Feb. 1980, 49p., ADA-084 737, 67 refs.

Cuymon, G.L., Johnson, T.C.

34-3200

MATHEMATICAL MODELS, FROST HEAVE, FROST PENETRATION, HEAT TRANSFER, SOIL WATER MIGRATION, PAVEMENTS, COMPUTERIZED SIMULATION, LABORATORY TECHNIQUES, FORECASTING.

A mathematical model of coupled heat and moisture flow in soils has been developed. The model includes algorithms for phase change of soil moisture and frost heave and permits several types of boundary and initial conditions. The finite element method of weighted residuals (Galerkin procedure) was chosen to simulate the spatial regime, and the Crank-Nicholson method was used for the time domain portion of the model. To facilitate evaluation of the model, the heat and moisture fluxes were essentially decoupled; moisture flux was then simulated accurately, as were heat flux and frost heave in a laboratory test. Comparison of the simulated and experimental data illustrates the importance of unsaturated hydraulic conductivity. It is one parameter which is difficult to measure and for which only a few laboratory test results are available. Therefore, unsaturated hydraulic conductivities calculated in the computer model may be a significant source of error in calculations of frost heave. The algorithm incorporating effects of surcharge and overburden was inconclusively evaluated. Time-dependent frost penetration and frost heave in laboratory specimens were closely simulated with the model. After 10 days of simulation, the computed frost heave was about 2.3 cm vs 2.0 cm and 2.8 cm in two tests. Frost penetration was computed as 15 cm and was measured at 12.0 cm and 12.2 cm in the two laboratory samples after 10 days.

CR 80-11
ROOF LEAKS IN COLD REGIONS: SCHOOL AT CHEVAK, ALASKA.

Tobiasson, W., et al, Apr. 1980, 12p., ADA-084 914.

Johnson, P.R.

34-3327

ROOFS, LEAKAGE, BUILDINGS, MELTWATER, SNOW ACCUMULATION, CONDENSATION, SUBPOLAR REGIONS.

Four types of roof leaks occurred at a new school building in Chevak, Alaska: 1) blowing snow entered the roof through eave vents and then melted, 2) slush and ice in roof valleys caused meltwater to overflow the valley flashing and run into the building, 3) water entered at a roof/wall intersection and 4) in many areas water entered through gaps in the sloping plywood deck. Sealing the eave vents made it impossible for blowing snow to enter the roof at the eaves. Electric heat tapes eliminated the valley icing problem. Missing flashing was responsible for the roof-wall intersection leaks. The absence of a vapor barrier in the roof was the cause of many leaks. It was recommended that the roof be repaired from the exterior by removing component elements down to the plywood deck, installing an adhered continuous vapor barrier and reassembling the roof. An alternative roof cladding of composition shingles was discussed as was conversion to a "cold roof." The roof was repaired and modified following recommendations, and problems appear to have been solved.

CR 80-12
SIMPLIFIED MODEL FOR PREDICTION OF NITROGEN BEHAVIOR IN LAND TREATMENT OF WASTEWATER.

Selim, H.M., et al, Apr. 1980, 49p., ADA-085 191, 23 refs.

Iskandar, I.K.

34-3263

WASTE TREATMENT, WATER TREATMENT, NUTRIENT CYCLE, SOIL CHEMISTRY.

A simplified model for simulation of nitrogen transformations and transportation in land treatment of wastewater is presented. The purpose of the model is to predict the behavior of NH4-N and NO3-N in the soil profile in land treatment systems. The program is based on the solution of the transient soil water flow equation simultaneously with the equations describing the transformation, transport, and plant uptake of nitrogen in the soil. The program is valid for uniform as well as multilayered soil profiles and can be adapted to incorporate various nitrogen transformation mechanisms and boundary conditions. The model can be used as a tool to predict the fate of nitrogen in land treatment systems. Model sensitivity to changes in the rate of nitrification, ammonium ion exchange, and rate of plant uptake of nitrogen is also described. Description of the computer program, the program listing, and an example of input data and a two-week computer simulation of output data are presented.

CR 80-13
FRACTURE BEHAVIOR OF ICE IN CHARPY IMPACT TESTING.

Itagaki, K., et al, June 1980, 13p., ADA-089 920, 17 refs.

Sabourin, L.

35-973

ICE CRACKS, FRACTURING, IMPACT TESTS, TEMPERATURE EFFECTS, DOPED ICE, ICE COMPOSITION, ICE CRYSTAL STRUCTURE.

Specimens prepared from various types of ice without introducing excessive defects were tested at temperatures ranging from -2 to -190C. These tests indicated slightly higher Charpy values at lower temperatures and in more highly dispersed material concentrations. Three modes of fracture occurred during testing. Depending on the temperature and the material composition, either of the first two modes, normal fracture or multiple fracture, will appear and will show a normal frequency distribution of Charpy values in each type of ice. The third mode, fracture from both ends, which frequently occurred in the (NH4F) doped ice, gave Charpy values two to five times higher than the mean value for normal fracture. It can, therefore, be concluded that certain types of doping can alter the mode of fracture, through which drastic modifications of impact resistance may be possible.

CR 80-14
GEOBOTANICAL ATLAS OF THE PRUDHOE BAY REGION, ALASKA.

Walker, D.A., et al, June 1980, 69p., Refs. p.45-47.

Everett, K.R., Webber, P.J., Brown, J.

35-2150

TUNDRA, GEOMORPHOLOGY, PERMAFROST, SOILS, VEGETATION, LANDFORMS, ECOSYSTEMS, MAPS, PLANTS (BOTANY), ENVIRONMENTS, PHOTOGRAPHY, ECONOMIC DEVELOPMENT, UNITED STATES—ALASKA—*PRUDHOE BAY.*

This atlas illustrates the interrelationships among the landforms, soils and vegetation of a portion of the Arctic Coastal Plain of Alaska. The Prudhoe Bay region is dominated by an alkaline peaty coastal tundra, a type that has not been intensively studied. Forty-two vegetation communities, thirteen major landforms, and eight soil types are described. Several of the plant communities and one soil, the Pergelic Cryoboroll, have not been described previously. The vegetation is discussed with respect to three important gradients: temperature, soil pH and soil moisture. Other aspects of the Prudhoe Bay environment, including geology, permafrost, and winter and summer climate, are discussed and illustrated. Also included are historical descriptions of the development of the oilfield and of selected scientific investigations in the Alaskan Arctic. Master maps present the landforms, soils and vegetation of a 145-sq km portion of the oilfield road network at a scale of 1:12,000. Derived geobotanical special purpose maps, useful for land-use planning and management of the ecosystem, are explained and several examples are shown for a 3.6 sq km portion of the oilfield.

CR 80-15
TIME CONSTRAINTS ON MEASURING BUILDING R-VALUES.

Flanders, S.N., June 1980, 30p., ADA-089 712, 18 refs.

35-1998

COLD WEATHER CONSTRUCTION, CONSTRUCTION MATERIALS, THERMAL PROPERTIES, THERMAL CONDUCTIVITY, BUILDINGS, HEAT FLUX, TIME FACTOR, COMPUTER APPLICATIONS, ANALYSIS (MATHEMATICS).

This report discusses the time constraints on measuring the thermal resistance (R-value) of building components. Temperature changes on either side of a building component perturb measurement accuracy. Long measurement times and measurement times corresponding to a consistent diurnal cycle can be satisfactory; however, individual temperature changes cause significant error for shorter measurement periods. This report shows how to scale the thermal properties of individual constituent materials in a building element to determine its characteristic thermal time constant. The report then demonstrates the size of measurement error resulting from a variety of changes in temperature with representative walls of different time constants.

CR 80-16
MORPHOLOGY AND DISTRIBUTION OF THE ACANTHOECIDAE (CHOANOFLAGELLATA) FROM THE WEDDELL SEA DURING THE AUSTRAL SUMMER, 1977.

Buck, K.R., July 1980, 26p., ADA-090 680, 35 refs.

35-1721

PLANKTON, MARINE BIOLOGY, SEA ICE DISTRIBUTION, OCEAN ENVIRONMENTS, ICE EDGE, CRYOBIOLOGY, ANTARCTICA—WEDDELL SEA.

Eight species of loricate choanoflagellates (Acanthoecidae) were observed in samples obtained from the Weddell Sea during the austral summer, 1977. Habitats in which choanoflagellates were found included the water column, the edges of ice floes, ponds on ice floes, and the interiors of ice floes. The presence of choanoflagellates within the ice indicates that there may be a closely coupled trophic relationship with the other biological components of the ice community, the ice algae and the bacteria. The presence in the ice of seven species with both a caudal appendage and anterior projections suggests a positive relationship between this lorica configuration and the ice habitat. Mechanisms of variance of transverse costal diameters between genera may be useful to the taxonomy and phylogeny of this family. (Auth. mod.)

CR 80-17
SNOW PADS USED FOR PIPELINE CONSTRUCTION IN ALASKA, 1976: CONSTRUCTION, USE AND BREAKUP.

Johnson, P.R., et al, July 1980, 28p., ADA-090 521, 11 refs.

Collins, C.M.

35-2584

COLD WEATHER CONSTRUCTION, PIPELINES, SNOW ROADS, PERMAFROST PRESERVATION, SNOW STRENGTH, SOIL TRAFFICABILITY, ENVIRONMENTAL PROTECTION, ARTIFICIAL SNOW.

Construction pads made of snow were used to build two sections of the Trans Alaska Pipeline and a small gas pipeline during the winter of 1975-76. Construction during the winter has become increasingly common in the Arctic. Surface travel and the use of heavy construction equipment on the unprotected tundra have been severely restricted, even during the winter, so the use of temporary winter roads and construction pads built of snow and ice has been advocated and is being adopted. The three snow construction pads mentioned above were the first snow roads and construction pads used on a large scale in Alaska. Snow roads and construction pads have two objectives: to protect the underlying vegetation and upper layers of the ground, and to provide a hard, smooth surface for travel and the operation of equipment. Several types have been built, and a brief discussion is given of their history and classification systems. The three snow construction pads used in construction of the Trans Alaska Pipeline and the small gas pipeline in 1975-76 were visited and observed while in use.

CR 80-18
HEAT AND MASS TRANSFER FROM FREELY FALLING DROPS AT LOW TEMPERATURES.

Zarling, J.P., Aug. 1980, 14p., ADA-090 522, 18 refs.

35-594

DROPS (LIQUIDS), FREEZING, HEAT TRANSFER, MASS TRANSFER, LOW TEMPERATURE TESTS, SUPERCOOLING, ICE PHYSICS, COMPUTER APPLICATIONS, CONSTRUCTION MATERIALS.

The use of ice as a structural material is common practice for certain applications in cold regions. Techniques such as surface flooding or water spraying are used to accelerate ice growth rates, thereby lengthening the winter construction season. This report examines the heat and mass transfer rates from freely falling water drops in cold air. Design equations which predict the amount of supercooling of the drops as a function of outdoor ambient temperature, drop size and distance of fall are given.

CR 80-19
ENVIRONMENTAL ENGINEERING AND ECOLOGICAL BASELINE INVESTIGATIONS ALONG THE YUKON RIVER-PRUDHOE BAY HAUL ROAD.

Brown, J., ed, Sep. 1980, 187p., ADA-094 497, Refs. p.151-155. For individual chapters see 35-1769 through 35-1772.

Berg, R.L., ed.

35-1768

ROADS, CONSTRUCTION, PERMAFROST, SEASONAL FREEZE THAW, REVEGETATION, PIPELINES, SOIL EROSION, ENVIRONMENTAL IMPACT, ENGINEERING, ECOLOGY.

During the period 1975-1978 the Federal Highway Administration sponsored a series of environmental engineering investigations along the Yukon River to Prudhoe Bay Haul Road. In 1976 the Department of Energy joined these investigations with a series of ecological projects which continue to the present. Both agencies' research efforts were conducted on a cooperative basis with CRREL's in-house research program. The objectives of the research focused on 1) an evaluation of the performance of the road, 2) an assessment of changes in the environment associated with the road, 3) documentation of flora and vegetation along the 577-km-long transect, 4) methodologies for revegetation and restoration, and 5) an assessment of biological parameters as indicators of environmental integrity. In support of these objectives, specific studies were undertaken that investigated the climate along the road, thaw and subsidence beneath and adjacent to the road, drainage and side slope performance, distribution and properties of road dust, vegetation distribution, vegetation disturbance and recovery, occurrence of weeds and weedy species, erosion and its control, revegetation and restoration, and construction of the fuel gas line. This report presents background information on the region, detailed results of the road thaw subsidence and dust investigations, and summaries of revegetation, fuel gas line, vegetation distribution, soil, and weed studies.

CR 80-20

INVESTIGATIONS OF SEA ICE ANISOTROPY, ELECTROMAGNETIC PROPERTIES, STRENGTH, AND UNDER-ICE CURRENT ORIENTATION.

Kovacs, A., et al, Sep. 1980, 18p., ADA-092 089, 16 refs.
Morey, R.M.
35-1891

SEA ICE, ANISOTROPY, ICE STRENGTH, ELECTROMAGNETIC PROPERTIES, ICE CRYSTAL STRUCTURE, BRINES, OCEAN CURRENTS, RADIO ECHO SOUNDINGS.

Results of impulse radar studies of sea ice give support to the concept of a sea ice model in which the ice bottom is composed of an array of lossy parallel plate waveguides. The fundamental relation between the average bulk brine volume of sea ice and its electrical and strength properties is discussed as is the remote detection of under-ice current alignment. It was found that 1) the average effective bulk dielectric constant is dependent upon the average bulk brine volume of the sea ice; 2) sea ice anisotropy, arising from a bottom structure of crystal platelets with a preferred c-axis horizontal alignment, can be detected by radio echo sounding measurements made not only on the ice surface but also from an airborne platform; 3) the effective coefficient of reflection from the sea ice bottom decreases with increasing average effective bulk dielectric constant of the ice, decreases with increasing bulk brine volume, and is typically one to two orders of magnitude lower than the coefficient of reflection from the ice surface; and 4) the losses in sea ice increase with increasing average bulk brine volume.

CR 80-21

MECHANICS OF CUTTING AND BORING. PART 5: DYNAMICS AND ENERGETICS OF INDENTATION TOOLS.

Mellor, M., Sep. 1980, 82p., ADA-092 365, 40 refs.
35-1892

DRILLING, ICE CUTTING, EXCAVATION, PERMAFROST, ROCK DRILLING, LOADS (FORCES), EQUIPMENT, DYNAMIC LOADS, STRESSES, DESIGN.

This report deals with the cutting of rock and other brittle materials by means of indentation tools. The principles of indentation cutters are dealt with at length, the coverage including elastic contact stresses for initial loading by various types of indenters, application of formal plasticity theory to penetration analysis, and a variety of theories and penetration analyses that are not based on plasticity theory. Practical indentation mechanisms are described, and theoretical analyses are given for the dynamics and energetics of various types of roller cutters. The final section reviews experimental investigations and results for rock-cutting discs, giving a systematic summary of available data.

CR 80-22

NEUMANN SOLUTION APPLIED TO SOIL SYSTEMS.

Lunardini, V.J., Oct. 1980, 7p., ADA-092 244, 12 refs.
35-1893

SOIL FREEZING, GROUND THAWING, FREEZE THAW TESTS, THERMAL CONDUCTIVITY, THERMAL DIFFUSION, ACTIVE LAYER, PHASE TRANSFORMATIONS, TIME FACTOR, ANALYSIS (MATHEMATICS).

The only complete, analytic solution for conduction problems with phase change is the Neumann solution. The Neumann solution is valid for phase change in a semi-infinite, homogeneous medium with a step change in surface temperature; starting from an initial temperature which can be different than or equal to the fusion temperature of the medium. The Neumann solution, when applied to soils, forms the basis of a number of formulae for calculating the depths of freezing or thawing. Widely used graphs were previously developed that are valid only when the ratios of the thermal conductivities and thermal diffusivities of the frozen and thawed soil are unity. In this report general charts, applicable to any property ratios, are developed. The figures have been drawn specifically for soil systems, but they are applicable to any material with appropriate property ratios.

CR 80-23

MODELING OF ANISOTROPIC ELECTROMAGNETIC REFLECTION FROM SEA ICE.

Golden, K.M., et al, Oct. 1980, 15p., ADA-094 620, 21 refs.
Ackley, S.F.
35-1722

ANISOTROPY, SEA ICE, ELECTROMAGNETIC PROPERTIES, BRINES, DIELECTRIC PROPERTIES, MATHEMATICAL MODELS, ICE CRYSTAL STRUCTURE, REFLECTIVITY, RADAR ECHOES.

The contribution of brine layers to observed reflective anisotropy of sea ice at 100 MHz is quantitatively assessed. The sea ice is considered to be a stratified, inhomogeneous, anisotropic dielectric consisting of pure ice containing ordered arrays of conducting inclusions (brine layers). Below the transition zone, the ice is assumed to have constant azimuthal c-axis orientation within the horizontal plane, so that the orientation of brine layers is uniform. The brine layers are also assumed to become increasingly well-defined with depth, since adjacent brine inclusions tend to fuse together with increasing temperature. A theoretical explanation for observed reflective anisotropy is proposed in terms of anisotropic electric flux penetration into the brine layers. Penetration anisotropy and brine layer geometry are linked to anisotropy in the complex dielectric constant of sea ice. In order to illustrate the above effects we present a numerical method of approximating the reflected power of a plane wave pulse incident on a slab of sea ice. Mixture dielectric constants, calculated for two polarizations of the incident wave, are used to calculate power reflection coefficients for the two polarizations.

CR 80-24

MEASUREMENT OF THE SHEAR STRESS ON THE UNDERSIDE OF SIMULATED ICE COVERS.

Calkins, D.J., et al, Oct. 1980, 11p., ADA-094 621, 15 refs.
Müller, A.
35-1723

ICE MECHANICS, SHEAR STRESS, HYDRAULICS, SUBGLACIAL OBSERVATIONS, SURFACE ROUGHNESS, WATER, VELOCITY, EXPERIMENTATION, MODELS.

The fluid shear stress applied to the underside of a simulated floating ice cover was measured in a laboratory flume. The measured values were compared with values of the shear stress computed from the von Karman-Prandtl velocity distribution fitted to the velocity profiles measured beneath the cover. For the lower velocity runs (about 0.079 m/s) the measured and computed values of the shear stress were in close agreement. At the high velocity flows (about 0.138 m/s) the measured values were roughly one-half those calculated from the velocity distribution. As the underside of the cover became increasingly rougher, the position of maximum velocity moved closer to the bottom of the channel. It was shown that the Darcy friction coefficient is exponentially related to a normalized ice cover thickness, which suggests that it is measure of the roughness of a fragmented ice cover.

CR 80-25

SINGLE AND DOUBLE REACTION BEAM LOAD CELLS FOR MEASURING ICE FORCES.

Johnson, P.R., et al, Oct. 1980, 17p., 15 refs.
Zarling, J.P.
35-1724

ICE LOADS, RIVER ICE, BRIDGES, MEASURING INSTRUMENTS, LOADS (FORCES).

Two new types of load cells for attachment to bridge piers and direct measurement of ice forces were developed and tested with one type being installed on a pier of the Yukon River Bridge northwest of Fairbanks, Alaska. Both types of load cells used beams supported by base plates and carried nose plates that were loaded by the ice. The loads were imposed at the beams at locations differing from the support reactions so that the loads developed moments in the beams. By instrumenting them with strain gauges, the loads could be measured. Details of the design of the load cells, the means of calculating the loads and experience obtained with load cells are discussed.

CR 80-26

BLOCK MOTION FROM DETONATIONS OF BURIED NEAR-SURFACE EXPLOSIVE ARRAYS.

Blouin, S.E., Dec. 1980, 62p., ADA-095 492, 31 refs.
35-1999

ROCK MECHANICS, EXPLOSION EFFECTS, EXPLOSIVES, SUBSURFACE STRUCTURES, SOIL MECHANICS.

A vital concern to the survivability of hardened underground structures in rock is the relative displacement induced along geologic discontinuities by nearby explosions. Such displacement, commonly termed block motion, can occur along faults, joints, bedding planes and other structural weaknesses in rock. This report documents all occurrences of block motion observed during the development of DIHEST, a series of shallow-buried high explosive experiments designed to simulate the direct induced ground motions from a nuclear surface burst. Instances of block motion are described, along with pertinent details of the explosive arrays, geology and ground motion fields. The influence of these and other factors on the direction and magnitude of block motion is discussed.

CR 80-27

PHASE CHANGE AROUND A CIRCULAR PIPE.

Lunardini, V.J., Dec. 1980, 18p., ADA-094 600, 12 refs.
35-1894

PIPES (TUBES), HEAT TRANSFER, PERMAFROST THERMAL PROPERTIES, STEFAN PROBLEM, PHASE TRANSFORMATIONS, FROZEN GROUND STRENGTH, THERMAL DIFFUSION, FREEZE THAW CYCLES, ANALYSIS (MATHEMATICS).

No general, analytical solution exists for phase change around a cylinder, thus, approximate methods have been evaluated. The heat balance integral technique applied to the cylinder gave excellent results when compared to published numerical solutions. Graphical solutions are given for phase change about a cylinder for ranges of the Stefan number, superheat parameter, and property value ratios for typical soils. An approximate, general solution has been derived which is reasonably accurate and can be used for any values of the above-mentioned parameters. The effective thermal diffusivity method has been shown to be useful for practical problems of phase change.

CR 80-28

CLEARING ICE-CLOGGED SHIPPING CHANNELS.

Vance, G.P., Dec. 1980, 13p., ADA-095 490, 18 refs.
35-2000

CHANNELS (WATERWAYS), ICE REMOVAL, ICE NAVIGATION, ICE CONDITIONS, RIVER ICE, STREAM FLOW, WATER LEVEL.

This report investigates the feasibility of clearing ice from the shipping channel of the St. Marys River. Four basic concepts are investigated: disposal under the ice, disposal on top of the ice, slurrying and rafting. Each technique was found to have application in limited portions of the river with the exception of disposal on top of the adjacent ice sheet, which is deemed feasible throughout the river system. Disposal onto the adjacent ice sheet will increase the free stream velocity less than 1.0 ft/s (30.5 cm/s) and raise the water level less than 1.0 ft (0.30 m). Further model and field tests are recommended to validate the findings of this report.

CR 80-29

FATE AND EFFECTS OF CRUDE OIL SPILLED ON SUBARCTIC PERMAFROST TERRAIN IN INTERIOR ALASKA.

Johnson, L.A., et al, Dec. 1980, 67p., ADA-095 491, Refs. p.41-43.
Sparrow, E.B., Jenkins, T.F., Collins, C.M., Davenport, C.V., McFadden, T.
35-2001

OIL SPILLS, PERMAFROST, VEGETATION, DAMAGE, SOIL MICROBIOLOGY, THAW DEPTH, SLOPES, FREEZE THAW CYCLES.

This study was conducted to determine the short- and long-term physical, chemical and biological effects of spills of hot Prudhoe Bay crude oil on permafrost terrain near Fairbanks, Alaska. Two experimental oil spills, one in winter and one in summer, of 7570 liters (2000 gallons) were made at a forest site. The winter-spill oil moved within the surface moss layer beneath the snow. The summer-spill oil moved primarily below the moss in the organic soil. The oil moved faster and further downslope in the summer spill. Oil in the winter spill stopped during the first day but remobilized and flowed further downslope in the spring. The total area affected by the summer spill was nearly one and one-half times as large as that affected by the winter spill. The initial heat of the spilled oil had little measurable thermal effect on the soil. However, thaw depth significantly increased following two full thaw seasons. The greatest increases occurred beneath oil blackened surfaces. Evaporation of volatile components is the most significant weathering process in the first two years. Volatiles evaporated faster from surface oil than from oil carried deeper into the soil profile. Microbial degradation has not been observed. The indigenous soil microbial populations responded differently to winter and summer oil applications, ranging from inhibition to stimulation, with stimulation appearing to predominate. Vegetation showed both immediate and long-term damage. Damage was greatest near the top of the slope and in areas with surface oil. Deciduous species showed damage faster than evergreen species.

CR 80-30

FIELD COOLING RATES OF ASPHALT CONCRETE OVERLAYS AT LOW TEMPERATURES.

Eaton, R.A., et al, Dec. 1980, 11p., ADA-095 489, 7 refs.
Berg, R.L.
35-2002

TEMPERATURE EFFECTS, BITUMINOUS CONCRETES, COOLING RATE, LOW TEMPERATURE TESTS, ROADS, PAVEMENTS, COMPACTION.

Six overlay test sections were placed on an existing test road in Hanover, New Hampshire, to gain experience in compaction of asphalt pavements at rolling temperatures as low as 150 F. The asphalt cement and aggregate used had mix characteristics similar to those of the mix expected to be used for a proposed overlay project at Thule Air Base, Greenland. Results of the overlay tests showed that computer-modeled cooling curves can be accurate predictors of the actual asphalt overlay cooling with time. In Addition, the effects of temperature upon compaction were determined and it was found that nuclear gauges, when used and calibrated properly, successfully monitored mix density changes during compaction.

CR 80-31

ICING ON STRUCTURES.

Minsk, L.D., Dec. 1980, 18p., ADA-095 474, 34 refs.

35-2003

STRUCTURES, ICING, ICE ACCRETION, ICE LOADS, ICE PREVENTION, HUMIDITY, WIND PRESSURE, ICE COVER THICKNESS.

Ice accretion on structures built on the earth's surface is discussed. Sources of water are the atmosphere or water bodies near or surrounding the structure. Ice types include frost, rime, glaze and spray; properties and conditions governing their formation are presented. Methods of estimating accretion rates and total accretion on structures are given, and extracts from U.S. and Canadian codes for ice and wind loads on structures are included. Techniques for preventing ice accretion or removing accreted ice are presented.

CR 81-01

ANALYSIS OF ICE JAMS AND THEIR METEOROLOGICAL INDICATORS FOR THREE WINTERS ON THE OTTAUQUECHEE RIVER, VERMONT.

Bates, R.E., et al, Feb. 1981, 27p., ADA-099 173, 11 refs.

Brown, M.-L.

35-3926

ICE JAMS, ICE BREAKUP, ICE FORMATION, RIVER ICE, METEOROLOGICAL DATA.

The formation of ice jams and their meteorological indicators were studied in detail for the winters of 1975-76, 1976-77 and 1977-78 on the Ottauquechee River at and east of Woodstock, Vermont. Meteorological data are presented for nearby National Weather Service Co-Operative Stations as well as for CRREL sites on the Ottauquechee River. The severity of each winter is discussed, as are the effects of a heavy rainfall on a high water-equivalent snow cover. The resultant runoff and subsequent ice jamming that occurs is discussed. Continuous monitoring of water temperature before, during and immediately after an ice cover formed on the river during the winter of 1977-78 is included. The report includes a section on warm sewer outfall effects on the ice at and below a municipal treatment plant. Retrieved data will assist in future modeling studies to help predict ice formation, growth, decay and jamming of river ice covers.

CR 81-02

HYPERBOLIC REFLECTIONS ON BEAUFORT SEA SEISMIC RECORDS.

Neave, K.G., et al, Mar. 1981, 16p., ADA-099 172, 8 refs.

Sellmann, P.V., Delaney, A.J.

36-318

BOTTOM SEDIMENT, SEISMIC REFLECTION, OCEAN BOTTOM, ICE CONDITIONS, SEA ICE, BEAUFORT SEA.

Many hyperbolic reflections have been observed on marine seismic records obtained during oil exploration in the Beaufort Sea, and on USGS seismic sub-bottom profiles from the Prudhoe Bay vicinity. A hyperbolic projection system was designed to rapidly measure seismic velocities from the curves on the records. The velocities observed were approximately the velocity of sound in water. The hyperbolic signals also showed dispersion properties similar to acoustic normal modes in shallow water. These observations indicate that the signals responsible for the hyperbolic reflections propagate as normal modes within the layer, with very limited penetration of the seabed. Determinations of the dominant frequency of these signals indicate that the penetration into the seabed has a characteristic attenuation depth (skin depth) of about 1.5 m for the sub-bottom profiles and 12 m for the marine records. It therefore appears that some hyperbolic reflections may be generated by variations in materials that occur near the seabed. There is some evidence of linearity of the anomalies, possibly related to sediment-filled or open ice gouges, or other changes in material properties at shallow depths.

CR 81-03

HYDRAULIC MODEL STUDY OF A WATER INTAKE UNDER FRAZIL ICE CONDITIONS.

Tantillo, T.J., Mar. 1981, 11p., ADA-099 171, 8 refs.

36-319

WATER INTAKES, ICE CONDITIONS, FRAZIL ICE, HYDRAULIC STRUCTURES, ICE PREVENTION, PROTECTION, MODELS, BUOYANCY.

A 1:24 scale hydraulic model study of a water intake under frazil ice conditions is presented. The intake, located 9 m below the surface of the St. Lawrence River in Massena, New York, has a throughflow of 0.14 cu m/s. The model study, conducted in the refrigerated flume facility of the U.S. Army Cold Regions Research and Engineering Laboratory, investigated methods of minimizing the frazil ice blockage on the intake. Two protective structures were modeled and the relative benefits of each are presented. The additional cross-sectional area provided by the protective structures lowered the vertical velocity component of the intake water to 0.0027 m/s. At this velocity the buoyant force acting on the frazil ice particle is larger than the downward drag force, causing the particle particle to rise. The results demonstrate that under certain low flow conditions a protective structure can minimize frazil ice blockage problems.

CR 81-04

MOVEMENT STUDY OF THE TRANS-ALASKA PIPELINE AT SELECTED SITES.

Ueda, H.T., et al, Apr. 1981, 32p., ADA-101 605, 3 refs.

Garfield, D.E., Haynes, F.D.

36-320

PIPELINES, MECHANICAL PROPERTIES, STABILITY, PIPELINE SUPPORTS, ANCHORS, UNITED STATES—ALASKA.

Eight sites along the trans-Alaska pipeline from the Denali Fault to Fairbanks were selected for pipeline and pipeline support movement studies. Four measurement surveys were conducted, starting before oil pumping operations began up to September 2, 1978, to determine the lateral and longitudinal pipe movement due to the thermal expansion of elevated sections of the pipeline, the tilt of the vertical support members (VSM's), and the changes in relative elevation of the support crossbeams. A maximum lateral and longitudinal motion of the pipe of 13 3/4 in and 2 3/16 in respectively were measured up to September 1978. Tilt data for 180 VSM's showed little change over a one-year period, with only 5 VSM's tilting more than 0.5 deg. Relative elevation measurements showed insignificant changes for two sites compared over a one-year period. Comparisons of our data with as-built elevations at 8 sites shows a few large differences that cannot be readily explained. In general the pipeline and its supports, at least at the sites studied, show minimal movement and activity.

CR 81-05

VIBRATIONS CAUSED BY SHIP TRAFFIC ON AN ICE-COVERED WATERWAY.

Haynes, F.D., et al, Apr. 1981, 27p., ADA-101 541, 11 refs.

Määttänen, M.

36-321

SHIPS, VIBRATION, ICE BREAKING, ICE COVER, FROZEN GROUND, SEISMOLOGY.

Vibrations have been felt on shore along the St. Marys River in Michigan during the passage of ships through ice. Vibration measurements were made on a ship, on the ice, on the shore, and on buildings along the shore. Vibration levels in 1979 were about an order of magnitude lower than levels that would cause damage to building walls. Two factors, however, could have reduced the vibration levels in 1979: a lack of ice jams and a record high snow cover which prevented the soil from freezing. Vibration levels with an ice cover are about four times those without an ice cover. Icebreaking and opening the channel can reduce vibration levels by about 50% for a ship following closely behind another ship. The dominant frequencies measured on shore were associated with propeller excitation. The dominant frequencies and magnitudes measured on the bow of a ship are an order of magnitude higher than those on the shore and are related to icebreaking by the bow. Vibration magnitudes are dependent upon the velocity of the ship, the energy expended by the ship, the cross-sectional area of the ship, weather, conditions of the ice and soil, and site-specific conditions. Further studies are needed to determine the effects of these factors and to determine the mode of energy transmission.

CR 81-06

INVESTIGATION OF THE ACOUSTIC EMISSION AND DEFORMATION RESPONSE OF FINITE ICE PLATES.

Xirouchakis, P.C., et al, Apr. 1981, 19p., ADA-103 731 .

Chaplin, M., St. Lawrence, W.F.

36-389

ICE ACOUSTICS, FRACTURING, ICE LOADS, PLATES, ICE DEFORMATION, ICE CRACKS, ANALYSIS (MATHEMATICS).

A procedure is described for monitoring the microfracturing activity in ice plates subjected to constant loads. Sample time records of freshwater ice plate deflections as well as corresponding total acoustic emission activities are presented. The linear elastic, as well as viscoelastic, response for a simply supported rectangular ice plate is given. Suggested future work using te above procedure is discussed.

CR 81-07

HYDRAULIC CHARACTERISTICS OF THE DEER CREEK LAKE LAND TREATMENT SITE DURING WASTEWATER APPLICATION.

Abele, G., et al, Apr. 1981, 37p., 3 refs.

McKim, H.L., Caswell, D.M., Brockett, B.E.

36-390

SOIL WATER, WASTE DISPOSAL, WATER TREATMENT, HYDRAULICS, DRAINAGE, IRRIGATION, SEEPAGE, LAND RECLAMATION.

During the summer of 1979, wastewater was applied 10 times to the Deer Creek Lake, Ohio land treatment site. Wastewater distribution on the ground during spray application is not uniform: some locations receive less than 70% and others more than 130% of the mean amount applied. The saturated infiltration rate ranges from moderately slow (0.6 cm/hr after 1 hr) to slow (0.3 cm/hr after 12 hours). The under-drain flow rate increases approximately as the cube of time until 1 hour after the end of application and then decreases as the reciprocal of time squared. The rate and amount of drainage increases with an increase in the initial soil water content and can be predicted from soil tension measurements. It was possible to calculate the mass water budget at the end of a typical application to within 88% of the actual water applied.

CR 81-08

SEASONAL GROWTH AND UPTAKE OF NUTRIENTS BY ORCHARDGRASS IRRIGATED WITH WASTEWATER.

Palazzo, A.J., et al, May 1981, 19p., ADA-101 613, 33 refs.

Graham, J.M.

36-391

GRASSES, NUTRIENT CYCLE, GROWTH, WASTE DISPOSAL, WATER TREATMENT, IRRIGATION, LAND RECLAMATION, SEASONAL VARIATIONS.

A 2-year field study determined the seasonal growth and nutrient accumulation of a forage grass receiving 7.5 cm/wk of primary treated domestic wastewater. The average N and P concentrations in the wastewater were 31.5 and 6.1 mg/l respectively. An established sward of Pennlate orchardgrass (Dactylis glomerata L.) was managed on an annual three cutting system. Grass samples were periodically taken to determine plant dry matter accumulation and uptake of N, P and K. Changes in nutrient uptake within a harvest period were related to both changes in dry matter accumulation and plant nutrient concentration. For maximum yields and nutrient removal, it is recommended that orchardgrass be initially harvested at the early heading stage of growth in the spring. Subsequent harvests should be performed at 5- to 6-week intervals. Average daily dry matter, N and P accumulation was greatest during the first harvest period (May in Hanover, N.H.). This would be the most appropriate time to increase the application rate, thus treating excess wastewater stored during the winter. Estimates of monthly plant removal for N and P are presented as a guide in designing land treatment systems according to the procedures given in the EPA/Corps Land Treatment Design Manual.

CR 81-09

ON THE BUCKLING FORCE OF FLOATING ICE PLATES.

Kerr, A.D., June 1981, 7p., ADA-103 733, 12 refs.

36-392

ICE LOADS, PLATES, FLOATING ICE, ICE COVER STRENGTH, DYNAMIC LOADS, MATHEMATICAL MODELS.

The calculation of the largest horizontal force a relatively thin floating ice plate may exert on a structure requires the knowledge of the buckling load for this floating plate. In the published literature on the stability of continuously supported beams and plates, it is usually assumed that this buckling force corresponds to the lowest bifurcation force p(cr). However, recent studies indicate that, generally, this is not the case, and this report clarifies the situation for floating ice plates. This problem is first studied on a simple model that exhibits the buckling mechanism of a floating ice plate but is amenable to an exact nonlinear analysis. This study shows that, depending on the ratio of the rigidities of the "liquid" and "plate", the post-buckling branch may rise or drop away from the bifurcation point.

CR 81-10

REVIEW OF THERMAL PROPERTIES OF SNOW, ICE AND SEA ICE.

Yen, Y.-C., June 1981, 27p., ADA-103 734, Refs. p.25-27.

36-393

ICE THERMAL PROPERTIES, SEA ICE, SNOW DENSITY, SNOW THERMAL PROPERTIES, ICE DENSITY, THERMAL PROPERTIES, COMPRESSIVE PROPERTIES, TERMAL EXPANSION.

This treatise thoroughly reviews the subjects of density, thermal expansion and compressibility of ice; snow density change attributed to destructive, constructive and melt metamorphism; and the physics of regelation and the effects on penetration rate of both the thermal properties of the wire and stress level. Heat capacity, latent heat of fusion and thermal conductivity of ice and snow over a wide range of temperatures were analyzed with regression techniques. In the case of snow, the effect of density was also evaluated. The contribution of vapor diffusion to heat transfer through snow under both natural and forced convective conditions was assessed. Expressions representing specific and latent heat of sea ice in terms of sea ice salinity and temperature were given. Theoretical models were given that can predict the thermal conductivities of fresh bubbly ice and sea ice in terms of salinity, temperature and fractional air content.

CR 81-11

PREDICTION OF EXPLOSIVELY DRIVEN RELATIVE DISPLACEMENTS IN ROCKS.

Blouin, S.E., June 1981, 23p., ADA-101 314, 15 refs.

36-394

ROCK MECHANICS, EXPLOSION EFFECTS, NUCLEAR EXPLOSIONS, SOIL MECHANICS, FORECASTING.

Relative displacement data from high explosive, shallow-buried bursts in rock are combined with relative displacement data from the contained nuclear explosion MIGHTY EPIC. Analysis of these data yields a preliminary, semi-empirical technique for predicting the location, direction and magnitude of relative displacements in rock from contained explosions. This technique is used to make relative displacement predictions for the DIABLO HAWK nuclear blast.

CR 81-12

REVEGETATION AND SELECTED TERRAIN DISTURBANCES ALONG THE TRANS-ALASKA PIPELINE, 1975-1978.

Johnson, A.J., June 1981, 115p., ADA-138 426, 41 refs.

38-4413

REVEGETATION, SOIL EROSION, GRASSES, PIPELINES, ENVIRONMENTAL IMPACT, POLAR REGIONS.

Revegetation techniques along the trans-Alaska pipeline as employed by Alyeska Pipeline Service Company during the 1975-1978 summers were observed. Objectives included determining the success of treatments, identifying problem areas, and noticing long-term implications. Observations and photographs at 60 sites located along the trans-Alaska pipeline indicated frequent occurrence of successful revegetation as well as frequent problems, such as erosion, slope instability, poor scheduling of seed application, occurrence of weed species, failure to optimally reuse topsoil and fine-grained soil, and low rates of native species reinvasion. Alyeska's visual impact engineering was observed to be very successful, as shown by high first-season survival. However, a related program for establishing willow cuttings was unsuccessful in 1977 but appeared very promising in 1978 largely due to improved management and more favorable growing conditions. Terrain disturbances due to the construction of the fuel gas line, snowpads, and oil spills were examined to identify and describe related environmental impacts on natural vegetation. Proper construction and use of snowpads minimized the extent and severity of disturbance. Crude oil spills, although damaging to vegetation, did not cause total kill of vegetation, and certain types of spills may have only short-term effects. Results of restoration research by CRREL along the trans-Alaska pipeline are discussed.

CR 81-13

VHF ELECTRICAL PROPERTIES OF FROZEN GROUND NEAR POINT BARROW, ALASKA.

Arcone, S.A., et al, June 1981, 18p., ADA-103 735, 32 refs.

Delaney, A.J.

36-395

PERMAFROST PHYSICS, DIELECTRIC PROPERTIES, RADIO WAVES, FROZEN GROUND PHYSICS, SOIL COMPOSITION, WATER CONTENT, ORGANIC SOILS.

Electrical properties of frozen ground were measured using radio frequency interferometry (RFI) in the very high frequency (VHF) radiowave band. Ice-rich organic silts and sands and gravels of variable ice content were investigated during early April of both 1979 and 1980. Frequencies between 10 and 150 MHz were used with best results obtained between 40 and 100 MHz. Surface impedance and magnetic induction techniques were also used to obtain an independent measure of low frequency resistivity and to obtain a separate control on vertical inhomogeneity. Soil samples were tested for organic and water content. The dielectric constants determined for the ice-rich organic silts ranged from 4.0 to 5.5 while those for the sands and gravels were about 5.1. Dielectric loss was due to d.c. conduction and was very low for the silts but significant for the sands and gravels. The higher values for the sands and gravels were most likely due to the higher concentrations of salt that are reported to exist in the old beach ridges in this region. All the RFI measurements are believed to be indicative of only the first few meters of the ground although the radiowaves could penetrate to tens of meters.

CR 81-14

WASTEWATER TREATMENT BY A PROTOTYPE SLOW RATE LAND TREATMENT SYSTEM.

Jenkins, T.F., et al, Aug. 1981, 44p., ADA-106 975, Refs. p.37-39.

Palazzo, A.J.

36-1308

WASTE TREATMENT, WATER TREATMENT, CHEMICAL ANALYSIS, NUTRIENT CYCLE, EVAPOTRANSPIRATION, PLANTS (BOTANY), SOIL WATER.

CR 81-15

STATISTICAL EVALUATION OF SOIL AND CLIMATIC PARAMETERS AFFECTING THE CHANGE IN PAVEMENT DEFLECTION DURING THAWING OF SUBGRADES.

Chamberlain, E.J., July 1981, 10p., ADA-106 976, 7 refs.

36-975

PAVEMENTS, DEFORMATION, SEASONAL FREEZE THAW, SUBGRADE SOILS, LOADS (FORCES), CLIMATIC FACTORS, FROST PENETRATION, STATISTICAL ANALYSIS.

This report analyzes the results of a field study previously reported by Scrivner et al (1969) for the National Cooperative Highway Research Program. These authors studied the seasonal pavement deflection characteristics of 24 test sites on roads in service in regions with freezing indexes ranging from 100F-days to 2100F-days. They used the Dynaflect cyclic pavement loading device to determine the pavement system response. Of specific interest to the analysis was the increased pavement deflection after freezing and thawing and the time to recovery of normal deflection characteristics. These characteristics were related to soil and climatic factors using statistical techniques. The most significant observations of this statistical analysis are: 1) that the freezing index is not a significant parameter in determining the percent increase in pavement deflection during thawing, and 2) that the recovery time is inversely proportional to the depth of freezing. As was expected, the most significant variable affecting the increase in pavement deflection was the frost susceptibility classification. This observation reinforces the necessity for careful selection of soil materials used in pavement systems.

CR 81-16

COLD REGIONS TESTING OF AN AIR-TRANSPORTABLE SHELTER.

Flanders, S.N., Aug. 1981, 20p., ADA-107 131, 9 refs.

36-1309

PORTABLE SHELTERS, TRANSPORTATION, COLD WEATHER PERFORMANCE, AIRPLANES, TESTS.

An air-transportable shelter designed and built at CRREL for use in cold regions underwent testing in Hanover, New Hampshire, and Ft. Greely, Alaska. The shelter demonstrated some of its capabilities for mobility by being towed for more than 60 miles behind various vehicles and by being transported on a C-130 cargo airplane, a CH-47 helicopter, and a trailer truck. The shelter proved to be very easy for a crew of two to four to set up in all weather conditions including -40F cold. However, the gasoline-powered generator, which was a source for space heat as well as electricity, functioned very poorly. Overall, the prototype successfully demonstrated qualities of self-reliance, ease of operation and thermal efficiency.

CR 81-17

SUBSEA TRENCHING IN THE ARCTIC.

Mellor, M., Sep. 1981, 31p., ADA-108 341, 44 refs.

40-4673

DREDGING, OCEAN BOTTOM, PIPE LAYING, ICE SCORING, ICE ACTION, EQUIPMENT, VELOCITY, ICEBERGS, PRESSURE RIDGES, PROTECTION.

Environmental conditions are described for the continental shelf of the western Arctic, and for the shelf of Labrador and Newfoundland. Special emphasis is given to the gouging of bottom sediments by ice pressure ridges and icebergs, and an approach to systematic risk analysis is outlined. Protection of subsea pipelines and cables by trenching and direct embedment is discussed, touching on burial depth, degree of protection, and environmental impact. Conventional land techniques can be adapted for trenching across the beach and through the shallows, but in deeper water special equipment is required. The devices discussed include hydraulic dredges, submarine dredges, plows, rippers, water jets, disc saws and wheel ditchers, ladder trenchers and chain saws, routers and slot millers, ladder dredges, vibratory and percussive machines, and blasting systems. Consideration is given to the relative merits of working with seabed vehicles, or alternatively with direct surface support from vessels or from the sea ice.

CR 81-18

CHENA RIVER LAKES PROJECT REVEGETATION STUDY—THREE-YEAR SUMMARY.

Johnson, L.A., et al, Oct. 1981, 59p., ADA-108 909, 22 refs.

Rindge, S.D., Gaskin, D.A.

36-2222

REVEGETATION, GRASSES, GROWTH, SOIL STABILIZATION, GRAVEL, VEGETATION, UNITED STATES—ALASKA—FAIRBANKS.

During the growing seasons of 1977, 1978 and 1979, revegetation techniques were studied on the Chena River Lakes Project, a flood control dam and levee near Fairbanks, Alaska, to find an optimal treatment for establishing permanent vegetation cover on the gravel structures. The treatments tested on plots at the dam and/or levee involved three main variables: 1) vegetation (grass and clover seed and/or willow cuttings), 2) mulch, mulch blanket, and/or sludge, and 3) substrate (gravel or fine-grained soil over the gravel base). The mulches were hay, wood-cellulose-fiber, peat moss, and Conwed Hydro Mulch 2000, which is a wood-cellulose-fiber mulch with a polysaccharide tackifier. A constant rate of fertilizer was applied to all plots except the control. A section of each plot was refertilized again in their third growing season to compare annual and biannual fertilization. The high fertilization rate produced above-average growth. Fescue, brome, and foxtail were the most productive species on the dam, while alsike clover was the most productive on the wetter levee site. When grass seed and willow cuttings were planted at the same time, willow survival and growth were reduced. Fertilization is required for at least two years to produce an acceptable permanent vegetation cover, although fine-grained soil or sludge reduces the amount of fertilizer needed in the second year. Third-year fertilization may be necessary since the benefits of the second fertilization continue for at least two years. A sludge treatment refertilized during its second growing season produces the highest biomass recorded in this study. Sludge from the Fairbanks treatment plant poses little, if any, danger of contamination from heavy metals or pathogens. Four-year-old seedlings of willow and native woody species growing on the dam do not have deeply penetrating root systems and therefore don't appear to pose an early threat of leakage through the dam.

CR 81-19

GROUND-TRUTH OBSERVATIONS OF ICE-COVERED NORTH SLOPE LAKES IMAGES BY RADAR.

Weeks, W.F., et al, Oct. 1981, 17p., ADA-108 342, 5 refs.

Gow, A.J., Schertler, R.J.

38-4414

LAKE ICE, ICE COVER THICKNESS, RADAR ECHOES, ICEBOUND LAKES, ICE WATER INTERFACE, SIDE LOOKING RADAR, UNITED STATES—ALASKA—NORTH SLOPE.

Field observations support the interpretation that differences in the strength of radar returns from the ice covers of lakes on the North Slope of Alaska can be used to determine where the lake is frozen completely to the bottom. An ice/frozen soil interface is indicated by a weak return and an ice/water interface by a strong return. The immediate value of this result is that SLAR (side-looking airborne radar) imagery can now be used to prepare maps of large areas of the North Slope showing where the lakes are shallower or deeper than 1.7 m (the approximate draft of the lake ice at the time of the SLAR flights). The bathymetry of these shallow lakes is largely unknown and is not obvious from their sizes or outlines. Such information could be very useful, for example in finding suitable year-round water supplies.

CR 81-20

SHALLOW SNOW MODEL FOR PREDICTING VEHICLE PERFORMANCE.

Harrison, W.L., Oct. 1981, 21p., ADA-108 343, 63 refs.

39-1261

SNOW ACCUMULATION, MOTOR VEHICLES, COLD WEATHER PERFORMANCE, TRACTION, SNOW COVER EFFECT, ICE COVER EFFECT, SLUSH, SNOW DEPTH, GROUND THAWING, FORECASTING, MODELS.

A historical review of research is presented to establish the state-of-the-art for analyzing the behavior of vehicles in shallow snow. From this review, the most comprehensive and promising model is put together to establish a first-cut performance prediction model for vehicles operating in shallow snow, slush, ice and thawing soils.

CR 81-21

NEAR-INFRARED REFLECTANCE OF SNOW-COVERED SUBSTRATES.

O'Brien, H.W., et al, Nov. 1981, 17p., ADA-110 868, 16 refs.

Koh, G.

36-2431

SNOW COVER EFFECT, SOLAR RADIATION, REFLECTION, SUBSTRATES, ICE CRYSTAL OPTICS, RADIOMETRY, METEOROLOGICAL DATA.

The reflection of solar radiation by a snow cover in situ and the apparent influence of selected substrates were examined in wavelength bands centered at 0.81, 1.04, 1.10, 1.30, 1.50 and 1.80 micrometers. Substrates included winter wheat, timothy, corn. alfalfa, grass, concrete and subsurface layers of "crusty" snow and ice. Reasonable qualitative agreement between measurements and theoretical predictions was demonstrated, with indications of quantitative agreement in the definition of a "semi-infinite depth" of snow cover. It was concluded that ultimate quantitative agreement between theory and measurement will require that an "optically effective grain size" be defined in terms of physically measurable dimensions or meteorologically predictable characteristics of the ice crystals composing the snow pack.

CR 81-22

ICE DISTRIBUTION AND WINTER SURFACE CIRCULATION PATTERNS, KACHEMAK BAY, ALASKA.

Gatto, L.W., Dec. 1981, 43p., ADA-110 806, 20 refs.

36-2432

ICE CONDITIONS, SEA ICE DISTRIBUTION, OCEAN CURRENTS, SUSPENDED SEDIMENTS, REMOTE SENSING, LANDSAT, UNITED STATES—ALASKA—KACHEMAK BAY.

Development of the hydropower potential of Bradley Lake, Alaska, would nearly double winter freshwater discharge from the Bradley River into upper Kachemak Bay, and the Corps of Engineers is concerned about possible subsequent increased ice formation and related ice-induced problems. The objectives of this investigation were to describe winter surface circulation in the bay and document ice distribution patterns for predicting where additional ice might be transported if if forms. Fifty-one Landsat MSS band 5 and 7 and RBV images with 70% cloud cover or less, taken between 1 November and 30 April each year, were analyzed for the eight winters from 1972 to 1980 with standard photointerpretation techniques. Results of this analysis showed that glacial sediment discharged into Kachemak Bay acts as a natural tracer in the water. Inner Kachemak Bay circulation in the winter is predominantly counterclockwise, with northeasterly nearshore currents along the south shore and southwesterly nearshore currents along the north shore. Most of the ice in the inner bay forms at its northeast end and is discharged by the Fox, Sheep and Bradley Rivers. Some ice becomes shorefast on the tidal flats at the head of the bay, while some moves southwestward along the north shore pushed by winds and currents.

CR 81-23

EVALUATION OF A COMPARTMENTAL MODEL FOR PREDICTION OF NITRATE LEACHING LOSSES.

Mehran, M., et al, Dec. 1981, 24p., ADA-111 560, 41 refs.

Tanji, K.K., Iskandar, I.K.

36-2284

WASTE TREATMENT, LEACHING, LAND RECLAMATION, WATER FLOW, SOIL CHEMISTRY, MODELS.

A model is presented that consists of a water flow submodel and a nitrogen flow submodel. Irrigation, precipitation, evapotranspiration, surface return flow, and deep percolation are considered in the water flow submodel. The processes of nitrification, denitrification, mineralization, immobilization, plant uptake, and nitrogen fixation are included in the nitrogen flow submodel. The model has been applied to two sets of experimental data obtained from 1) controlled test cells at U.S. Army Cold Regions Research and Engineering Laboratory in Hanover, New Hampshire, and 2) field plots of the University of California at Davis. Comparison between the experimental and model results indicates the potential capabilities of compartmental models in predicting nitrogen behavior in soil-water-plant systems under wastewater land treatment operations. This model is applicable to slow rate, rapid infiltration, and overland flow systems.

CR 81-24

TRANSIENT ANALYSIS OF HEAT TRANSMISSION SYSTEMS.

Phetteplace, G., Dec. 1981, 53p., ADA-112 365, Refs. p.46-47.

36-2753

HEAT LOSS, UNDERGROUND PIPELINES, HEATING, PUMPS, TEMPERATURE EFFECTS, ANALYSIS (MATHEMATICS, COST ANALYSIS, SOIL TEMPERATURE, COMPUTER PROGRAMS.

This report develops a method of analysis for heat transmission systems operating under district heating load conditions. The use of thermal energy storage systems is outlined and advantages are given. The method accounts for the effects of heat source and load characteristics. The transmission model itself considers the following technical aspects: 1) frictional pressure losses in piping systems, 2) pump characteristics, 3) pump driver characteristics, and 4) heat losses from the buried piping. The capital costs considered are the piping system and necessary pumps. Operation and maintenance costs include cost of heat loss and cost of pumping energy input. Allowances are also made for system maintenance and repair over the assumed lifetime. The heat transmission problem is formulated in the forms of a two-dimensional optimization problem. The decision variables are pipe diameter and supply temperature. The problem is solved by direct search techniques using a Hooke-Jeeves pattern search algorithm. Parametric results are presented along with suggestions for further work.

CR 81-25

APPLICATION OF THE HEAT BALANCE INTEGRAL TO CONDUCTION PHASE CHANGE PROBLEMS.

Lunardini, V.J., Dec. 1981, 14p., ADA-112 813, 15 refs.

36-2669

THERMAL CONDUCTIVITY, PHASE TRANSFORMATIONS, HEAT TRANSFER, FREEZE THAW CYCLES, FROZEN GROUND PHYSICS, STEFAN PROBLEM, HEAT FLUX, ANALYSIS (MATHEMATICS), COMPUTER APPLICATIONS, CONVECTION.

The problem of heat conduction with phase change—often called the Stefan problem—includes some of the most intractable mathematical areas of heat transfer. Exact solutions are extremely limited and approximate methods are widely used. This report discusses the collocation method for the heat balance integral approximation. The method is applied to some standard problems of phase change—Neumann's problem—and a new solution is presented for the case of surface convection for a semi-infinite body. Numerical results are given for soil systems and also for materials of interest in latent heat thermal storage.

CR 81-26

MECHANICS OF CUTTING AND BORING. PART 7: DYNAMICS AND ENERGETICS OF AXIAL ROTATION MACHINES.

Mellor, M., Dec. 1981, 38p., ADA-113 931, 10 refs.

36-3110

DRILLS, PERMAFROST, ROCK DRILLING, EQUIPMENT, THERMAL EFFECTS, DRILLING FLUIDS, ANALYSIS (MATHEMATICS).

This report deals with force, torque, energy and power in machines such as drills and boring devices, where the cutting head rotates about a central axis while penetrating parallel to that axis. Starting from a consideration of the forces developed on individual cutting tools, or segments of cutters, the thrust and torque on a complete cutting head is assessed, and simple relationships between thrust and torque are derived. Similarly, the energy and power needed to drive the cutting head are estimated and related to tool characteristics. Design characteristics of existing machines are compiled and analyzed to give indications of thrust, torque, power, effective tool forces, nominal thrust pressure, power density, and specific energy.

CR 81-27

SEDIMENTOLOGICAL CHARACTERISTICS AND CLASSIFICATION OF DEPOSITIONAL PROCESSES AND DEPOSITS IN THE GLACIAL ENVIRONMENT.

Lawson, D.E., Dec. 1981, 16p., ADA-113 261, 33 refs.

36-2754

GLACIAL DEPOSITS, GLACIOLOGY, SEDIMENTATION, GLACIER OSCILLATION, PERIGLACIAL PROCESSES, GLACIER FLOW, ENVIRONMENTS, CLASSIFICATIONS.

Existing classifications for deposits in the glacial environment are inadequate and inconsistent. Deposits should be classified both descriptively and genetically; adequate descriptive classifications already exist. A major problem for previous genetic classifications has been that glacial deposition and the resulting deposits' properties were poorly understood. On the basis of three criteria—sediment source, uniqueness to the glacial environment, and preservation of glacier-derived properties—deposits in the glacial environment result from either of two groups of processes: primary or secondary. Primary processes release the debris of the glacier directly and form deposits that may bear properties related to the glacier and its mechanics. Their deposits are classified genetically as till and are the only deposits indicative of glaciation. In contrast, secondary processes mobilize, rework, transport and resediment debris and deposits in the glacial environment. They develop new, nonglacial properties in their deposits, while destroying or substantially modifying glacier-derived properties. Interpretation of their properties may provide information on the depositional process and/or the local depositional environment. Secondary deposits are resedimented and therefore not till. They are classified genetically according to the depositional process just as they are in other sedimentary environments. This genetic classification differs from previous classifications in that not all diamictons deposited in the glacial environment are classified as till; it is based strictly on process-related criteria. The origin of properties of glacial deposits in relation to glacier mechanics and environment must be recognized if the mechanisms and depositional processes of former glaciers are to be precisely understood.

CR 82-01

ALASKA GOOD FRIDAY EARTHQUAKE OF 1964.

Swinzow, G.K., Feb. 1982, 26p., ADA-113 800.

36-2838

EARTHQUAKES, FROZEN GROUND STRENGTH, DAMAGE, ICE SHEETS, ROCK MECHANICS, STRUCTURES, WATER WAVES, UNITED STATES—ALASKA—ANCHORAGE.

On 27 March 1964, a major earthquake struck Southern Alaska. The city of Anchorage, which contained a large part of Alaska's population, suffered loss of life and destruction of property. The time of the day, the season, and ground conditions were such that loss of life and property was minimized. The frozen ground and the ice on fresh water bodies responded to the earthquake shocks in a seldom-observable pattern, which was noted and recorded. Changes of sea level and slides into the sea were responsible for waterfront destruction. It is concluded that the main factor that limited structural damage was the frozen state of the ground.

CR 82-02

DEVELOPMENT OF A RATIONAL DESIGN PROCEDURE FOR OVERLAND FLOW SYSTEMS.

Martel, C.J., et al, Feb. 1982, 29p., ADA-113 762, 22 refs.

Jenkins, T.F., Diener, C.J., Butler, P.L.

39-1262

SEWAGE TREATMENT, WATER TREATMENT, WASTE TREATMENT, FLOODING, DESIGN.

This report describes the development of a new design procedure for overland flow systems that is based on hydraulic detention time, a familiar concept in wastewater treatment process design. A two-year study was conducted at Hanover, New Hampshire, on a full-scale overland flow site to obtain performance data in relation to detention time. Kinetic relationships were developed for removal of biochemical oxygen demand, total suspended solids, ammonia, and total phosphorus. Also, an empirical relationship was developed to predict hydraulic detention time as a function of application rate, terrace length, and slope. These relationships were validated using published data from other systems. An advantage of the new procedure, which should significantly reduce site preparation costs, is that it allows overland flow systems to be designed for a wide range of site conditions as long as detention time requirements are met.

CR 82-03

BREAKUP OF SOLID ICE COVERS DUE TO RAPID WATER LEVEL VARIATIONS.

Billfalk, L., Feb. 1982, 17p., ADA-112 819, 19 refs.

36-2650

ICE BREAKUP, ICE COVER THICKNESS, RIVER ICE, WATER LEVEL, WATER WAVES, FLEXURAL STRENGTH, FREEZEUP, VARIATIONS, ICE FORMATION, TIME FACTOR, ICEBOUND RIVERS, ANALYSIS (MATHEMATICS).

The conditions that lead to initial breakup of a solid ice cover on a river due to rapid water level variations are analyzed. The analysis is based on the theory of beams on an elastic foundation. First cracking is assumed to occur when the bending moment induced in the ice cover by the wave exceeds the flexural strength of the ice cover.

CR 82-04

SEA ICE DRAG LAWS AND SIMPLE BOUNDARY LAYER CONCEPTS, INCLUDING APPLICATION TO RAPID MELTING.

McPhee, M.G., Feb. 1982, 17p., ADA-113 542, 24 refs.

36-2839

SEA ICE, DRIFT, BOUNDARY LAYER, ICE MELTING, STRESSES, TURBULENT FLOW, VELOCITY, VISCOSITY, BUOYANCY, MATHEMATICAL MODELS.

Several proposed methods for treating the momentum flux between drifting sea ice and the underlying ocean are interpreted in terms of simple planetary-boundary-layer (PBL) turbulence theory. The classical two-layer approach, in which the solution for a thin surface layer is matched to an Ekman solution for the outer layer, is used to derive several forms for the drag law. These forms range from linear (where stress is proportional to relative speed), through quadratic drag on geostrophic wind in the atmosphere. Only formulations which conform with Rossby-similarity scaling are consistent with free-drift data from the 1975 AIDJEX drift station experiment. We show how a two-layer model, in thickness, provides an analytic solution for the steady-state PBL equation quite similar to recent numerical solutions. The theory is extended to include drag reduction due to buoyancy from rapid melting and is shown to agree with atmospheric results for geostrophic drag under analogous conditions of radiational cooling. The theory provides a basis for estimating trajectories and melt rates of floes drifting into water warmer than the ice melting temperature.

CR 82-05

ON THE TEMPERATURE DISTRIBUTION IN AN AIR-VENTILATED SNOW LAYER.

Yen, Y.-C., Mar. 1982, 10p., ADA-115 598, 9 refs.

39-1263

SNOW TEMPERATURE, HEAT TRANSFER, MASS TRANSFER, TEMPERATURE GRADIENTS, FLOW RATE, TEMPERATURE DISTRIBUTION, DIURNAL VARIATIONS, ANALYSIS (MATHEMATICS).

The problem of simultaneous heat and mass transfer in a homogeneous snow layer, with one side kept at its initial temperature and the other side with a step temperature increase, was solved for the case of constant through-flow conditions. An experimentally determined effective thermal conductivity function, i.e. $Ke=0.0014+0.58\ G$ (where G is dry mass flow rate of air in g/cm2s), was employed in the solution. The computed nondimensional temperature distribution agreed quite well with experimental data taken under pseudo-steady state conditions with the exception of the temperature for the lowest flow rate used in the experiment. The pronounced nonlinearity of the temperature distribution was found to be a strong function of the flow rate. For sinusoidal variation of atmospheric pressure, the responding flow in the snow medium was also found to be sinusoidal. In conjunction with the diurnal temperature change, this variation facilitated the process of repeated sublimation and condensation in alternate directions and thereby produced a surface layer of approximately constant snow density.

CR 82-06

MEASUREMENT OF GROUND DIELECTRIC PROPERTIES USING WIDE-ANGLE REFLECTION AND REFRACTION.

Arcone, S.A., et al, Mar. 1982, 11p., ADA-119 596, 11 refs.

Delaney, A.J.

40-4674

SOIL PHYSICS, DIELECTRIC PROPERTIES, RADAR ECHOES, GEOPHYSICAL SURVEYS, REFRACTION, EQUIPMENT, WAVE PROPAGATION.

The interpretation of continuous radar profiles requires an alternative geophysical means of obtaining ground dielectric information. Ground dielectric properties were measured using wide-angle reflection and refraction (WARR) soundings with a ground-probing radar set that transmits pulses of a few nanoseconds duration. The investigations, carried out over sandy gravel in interior Alaska, provided dielectric data to about a 5-m depth. The WARR soundings were displayed as individual traces allowing interference between separate events and dispersion to be observed, and the soundings were compared with continuous radar and resistivity profiles conducted concurrently to extract the maximum amount of dielectric information. The dielectric constants, derived mainly from the direct ground waves propagating along the surface, ranged from 2.9 to 7.4. Dielectric values interpreted for one site predicted the possibility of a refracted event which may have occurred during one of the soundings.

CR 82-07

CHARGED DISLOCATION IN ICE. 2. CONTRIBUTION OF DIELECTRIC RELAXATION.

Itagaki, K., Mar. 1982, 15p., ADA-113 936, 18 refs.,
The results indicate that the charged dislocation process can produce the observed audio frequency dielectric relaxation as well as the distribution of spectra.
36-2840

ICE ELECTRICAL PROPERTIES, ICE RELAXATION, DISLOCATIONS (MATERIALS), ICE CRYSTALS, DIELECTRIC PROPERTIES, ELECTRIC CHARGE, RELAXATION (MECHANICS), ANALYSIS (MATHEMATICS), SPECTRA.

The contribution of electrically-charged dislocation motion to dielectric relaxation was studied theoretically. Experimentally obtained data on charge density, dislocation density, and segment length and distribution described in Part 1 of this series were used to calculate dielectric relaxation spectra.

CR 82-08

EVALUATION OF METHODS FOR CALCULATING SOIL THERMAL CONDUCTIVITY.

Farouki, O., Mar. 1982, 90p., 24 refs.
37-221

FROZEN GROUND PHYSICS, THERMAL CONDUCTIVITY, PERMAFROST HEAT TRANSFER, SOIL COMPOSITION, SOIL WATER, COMPUTER PROGRAMS, TESTS.

A detailed analysis of methods for calculating the thermal conductivity of soils is presented, and trends in the predictions of these methods are compared. The influence of changes in the moisture content on the calculated thermal conductivity of a soil is shown, as is the sensitivity of this calculated value to changes in dry density or in the soil solids' thermal conductivity. The methods are evaluated to determine the extent of agreement of their predictions with measured values obtained on soils of known composition and properties. The deviations of the predicted values are determined for soils that are unfrozen or frozen, coarse or fine, unsaturated, saturated or dry. The applicability of each of the methods under various conditions is determined and recommendations are made as to the best method for each condition.

CR 82-09

MODEL STUDY OF PORT HURON ICE CONTROL STRUCTURE; WIND STRESS SIMULATION.

Sodhi, D.S., et al, Apr. 1982, 27p., ADA-115 417, 14 refs.
Calkins, D.J., Deck, D.S.
36-3111

ICE CONTROL, LAKE ICE, WATER PRESSURE, WIND PRESSURE, WATER FLOW, SHEAR STRESS, ICE NAVIGATION, PORTS, MODELS.

This study deals with the distribution of forces along the converging boundaries of the Port Huron, Michigan, region where unconsolidated ice in Lake Huron is held against wind and water stresses. An experimental basin was built to induce uniform shear stress on the model ice cover by flowing water beneath the ice. The boundary segments, which held the ice cover in the region, were instrumented to measure force in the normal and tangential directions. The distribution of normal forces along the boundary was compared with a distribution derived by using a theoretical model. An ice control structure (ICS) was installed in the basin and experiments were conducted to measure the forces on the ICS and the ice release through the opening in the ICS during simulated ship passages. The experimental results are presented in a nondimensional form. In addition, the force per unit length on the ICS and the area of ice released through its opening were estimated for the expected wind conditions at the Port Huron site.

CR 82-10

LABORATORY MEASUREMENTS OF SOIL ELECTRIC PROPERTIES BETWEEN 0.1 AND 5 GHZ.

Delaney, A.J., et al, Apr. 1982, 12p., ADA-115 126.
Arcone, S.A.
40-4675

PERMAFROST PHYSICS, SOIL PHYSICS, DIELECTRIC PROPERTIES, ELECTROMAGNETIC PROSPECTING, WAVE PROPAGATION, SOIL WATER, GROUND ICE, SANDS, SEDIMENTS, REFLECTION.

Dielectric measurements have been performed on silt and sand samples from permafrost areas using time domain reflectometry. The sample temperatures were varied from + 25 C to -25 C, and volumetric water content was varied between oven-dry and 0.55 g H2O/cc. The data were processed for frequencies between 0.1 and 5.0 GHz. The results show a constant K' and a low K' for frequencies up to 1 GHz. A frequency dependence seen on the data above 2 GHz is probably the result of unfrozen, adsorbed water. At moisture levels near saturation at all temperatures, these soils have excellent propagation characteristics for ground-probing radar operating below 0.3 GHz. Massive ice should be easily detectable in permafrost within a few degrees of 0 C.

CR 82-11

SHORELINE CONDITIONS AND BANK RECESSION ALONG THE U.S. SHORELINES OF THE ST. MARYS, ST. CLAIR, DETROIT AND ST. LAWRENCE RIVERS.

Gatto, L.W., May 1982, 75p., ADA-116 398, 31 refs.
39-1264

BANKS (WATERWAYS), EROSION, SHORELINE MODIFICATION, RIVERS, ICE NAVIGATION, PHOTOINTERPRETATION, SOIL EROSION, SLIDING, CHARTS, AERIAL SURVEYS, SEASONAL VARIATIONS.

The purpose of this investigation was to provide data to be used in evaluating the effects of winter navigation on processes that cause bank erosion. The specific objectives were to document bank conditions and erosion sites along the rivers, to monitor and compare the amounts of winter and summer bank recession and change, and to estimate the amount of recession that occurred prior to winter navigation. Shoreline conditions and bank recession were documented during field surveys each spring and fall. Bank changes were evaluated by comparison to observations from a previous survey. Aerial photointerpretation was done to estimate the amount of bank recession that occurred prior to winter navigation. Three hundred forty-five miles of river shoreline were surveyed. Banks were eroding along 21.5 miles (6.2%). The common types of bank failures were soil falls (sloughing) and block sliding and slumping. The erosion along approximately 15 miles (70%) of the 21.5 miles was occurring along reaches not bordering winter navigation channels.

CR 82-12

SENSIBLE AND LATENT HEAT FLUXES AND HUMIDITY PROFILES FOLLOWING A STEP CHANGE IN SURFACE MOISTURE.

Andreas, E.L., Apr. 1982, 18p., ADA-115 596, 42 refs.
39-1265

HEAT FLUX, LATENT HEAT, SURFACE PROPERTIES, ANALYSIS (MATHEMATICS), HUMIDITY, BOUNDARY LAYER, FRICTION, WIND FACTORS.

From a high-quality set of velocity, temperature, and humidity profiles collected upwind and downwind of a step change in surface roughness, temperature, and moisture, upwind and downwind values of the heat fluxes and friction velocity are calculated.

CR 82-13

NUMERICAL SOLUTIONS FOR A RIGID-ICE MODEL OF SECONDARY FROST HEAVE.

O'Neill, K., et al, Apr. 1982, 11p., ADA-115 597, For another version see 36-54. 11 refs.
Miller, R.D.
39-1266

FROST HEAVE, SOIL FREEZING, ICE MODELS, REGELATION, ICE FORMATION, GROUNDED ICE, HEAT TRANSFER, MASS TRANSFER, THERMODYNAMICS, ANALYSIS (MATHEMATICS).

In this paper, frost heave is analyzed for the common case in which some ice penetrates the soil. In this situation, heave is due to the accumulation of soil-free ice just within the frozen zone, behind a frozen fringe of finite thickness. Heat and mass transport within and across that fringe are crucial processes in the dynamics of heave. This analysis concentrates on activity within the fringe, also connecting that activity to heat and mass flows in the more frozen and unfrozen zones. Each component in a set of governing differential equations is developed from rational physics and thermodynamics, using previous experimental work. It is assumed that the soil ice grows through interconnected interstices; hence it constitutes and can move as a rigid body. When this assumption is translated into mathematical terms, it completes the governing equations. The model resulting from these considerations is a one-dimensional finite element computer program that solves the equations for arbitrary initial and boundary conditions. The model is used to simulate the heave history of a hypothetical soil column frozen unidirectionally and subjected to a surcharge. The results are gratifying in that they predict qualitatively the characteristics of numerous laboratory observations. Some questions about the completeness of the theory remain, and strict verification of the model awaits further experimentation and better parameter identification.

CR 82-14

COMPARATIVE ANALYSIS OF THE USSR CONSTRUCTION CODES AND THE US ARMY TECHNICAL MANUAL FOR DESIGN OF FOUNDATIONS ON PERMAFROST.

Fish, A.M., May 1982, 20p., ADA-116 234, 27 refs.
39-1267

PERMAFROST BENEATH STRUCTURES, FROZEN GROUND SETTLING, COLD WEATHER CONSTRUCTION, FOUNDATIONS, PILES, DESIGN CRITERIA, BUILDING CODES, FROZEN GROUND STRENGTH, SAFETY, USSR.

A comparative study was made of design criteria and analytical methods for footings and pile foundations on permafrost employed in U.S.S.R. Design Code SNiP 11-18-76 (1977) and U.S. Army Cold Regions Research and Engineering Laboratory Special Report 80-34 developed in the early 1970's by the U.S. Army Corps of Engineers and published in 1980. The absence of adequate constitutive equations for frozen soils and of rigorous solutions of the boundary problems has made it necessary to incorporate (explicitly or implicitly) various safety factors in the foundation analyses. From the review it is concluded that the principal difference between these practices is in the assessment and application of appropriate values of safety factors, which leads to a substantial discrepancy in the dimensions and cost of footings and pile foundations in permafrost.

CR 82-15

RELATIONSHIP BETWEEN THE ICE AND UNFROZEN WATER PHASES IN FROZEN SOIL AS DETERMINED BY PULSED NUCLEAR MAGNETIC RESONANCE AND PHYSICAL DESORPTION DATA.

Tice, A.R., et al, June 1982, 8p., ADA-118 486, 14 refs.
Oliphant, J.L., Nakano, Y., Jenkins, T.F.
37-48

FROST HEAVE, GROUND WATER, FROZEN GROUND, NUCLEAR MAGNETIC RESONANCE, UNFROZEN WATER CONTENT, SOIL TEMPERATURE.

An experiment is described that demonstrates the balance between the ice and the unfrozen water in a frozen soil as water is removed. Nuclear magnetic resonance (NMR) is used to monitor the unfrozen water content as the soil is dehydrated by a molecular sieve material. Our results show that the unfrozen water content of a Morin clay soil remains constant until the total water content has been reduced to the point where no ice remains in the system. Once the ice is depleted, the unfrozen water content determined by NMR corresponds to the toal water content of the soil determined by the weight of water removed by the molecular sieve material. Thus the validity of utilizing NMR in determining unfrozen water contents vs temperature is established.

CR 82-16

APPLICATION OF A NUMERICAL SEA ICE MODEL TO THE EAST GREENLAND AREA.

Tucker, W.B., Aug. 1982, 40p., ADA-120 659, For another version see 36-3254. 37 refs.
39-1268

ICE MODELS, DRIFT, SEA ICE, THERMODYNAMICS, ICE STRENGTH, MATHEMATICAL MODELS, ICE COVER THICKNESS, ICE GROWTH, VELOCITY, HEAT FLUX, OCEAN CURRENTS, WIND FACTORS, GREENLAND.

A dynamic-thermodynamic sea ice model which employs a viscous-plastic constitutive law has been applied to the East Greenland area. The model is run on a 40-km spatial scale at 1/4-day time steps for a 60-day period with forcing data beginning on 1 October 1979. Results tend to verify that the model predicts reasonable thicknesses and velocities within the ice margin. Thermodynamic ice growth produces excessive ice extent, however, probably due to inadequate parameterization of oceanic heat flux. Ice velocities near the free ice edge are also not well simulated, and preliminary investigations attribute this to an improper wind field in this area. A simulation which neglects ice strength, effectively damping ice interaction with itself and allowing no resistance to deformation, produces excessive ice drift toward the coast and results in unrealistic nearshore thicknesses. A dynamics-only simulation produced reasonable results, including a more realistic ice extent, but the need for proper thermodynamics is also apparent. Other simulations verify that ice import from the Arctic Basin, and ice transport due to winds and currents, were also important components in the model studies.

CR 82-17

SEISMIC SITE CHARACTERIZATION TECHNIQUES APPLIED TO THE NATO RSG-11 TEST SITE IN MÜNSTER NORD, FEDERAL REPUBLIC OF GERMANY.

Albert, D.G., July 1982, 33p., ADA-119 390, 15 refs.
39-1269

SEISMIC REFRACTION, GEOLOGIC STRUCTURES, WAVE PROPAGATION, SEISMOLOGY, VELOCITY.

Seismic P and SH wave refraction experiments at the NATO RSG-11 test site in Münster Nord, Federal Republic of Germany, reveal the presence of a nearly horizontal, three-layer velocity structure. The upper layer, composed of unconsolidated glacial till, is 1 m thick and has P (compressional) and SH (shear-horizontal) wave velocities of 240 and 165 m/s. The second layer, made up of similar, more compacted material, is 9.5 m thick, with a P wave velocity of 470 m/s and an SH wave velocity of 275 m/s. The third layer, interpreted as the groundwater table, is located at a depth of 10.5 m and has a P wave velocity of 1590 m/s. The SH wave velocity of this layer is controlled by the matrix material and is the same as that of the second layer. A single, unreversed observation indicated a fourth layer at a depth of about 20 m, but the existence of this layer remains unconfirmed. The observed fundamental mode Love wave dispersion is in agreement with the theoretical dispersion predicted by the refraction velocities. Computed partial derivatives of phase velocity with respect to shear wave velocity show, for the frequencies observed, that the dispersion confirms the thicknesses and velocities of the two upper layers and is not affected by the deeper structure.

CR 82-18
OPTIMIZING DEICING CHEMICAL APPLICATION RATES.
Minsk, L.D., Aug. 1982, 55p., ADA-119 681, 8 refs.
39-1270
CHEMICAL ICE PREVENTION, ICE CONTROL, SALTING, ROAD ICING, SNOW REMOVAL, ICE REMOVAL, SAFETY, FRICTION, TRAFFICABILITY.

Snow and ice control on highways has come to rely heavily on the sodium chloride to maintain a trafficable surface for unimpeded movement. Empirical approaches have led to a wide range of application rates, some clearly excessive, but justified on the ground of safety and expediency. The combination of environmental degradation from the huge quantities of salt entering the environment, along with the increased cost of salt itself and the cost of its application have spurred the search for more precise knowledge of the proper amount of salt to apply to a pavement, considering a range of environmental, traffic and chemical parameters. Since controlled tests in the field are extremely difficult to make, a circular test track of three test pavements, dense-graded asphaltic concrete (DGA), open-graded asphaltic concrete (OGA) and portland cement concrete (PCC), was constructed in a coldroom. Natural snow and ice were applied to the pavements and an instrumented slipping wheel was driven over the surfaces to generate frictional forces. These forces were measured and then used to evaluate the response to salt application with time for three test temperatures. OGA had the lowest friction values at a temperature near the freezing point, but higher initial values or more rapidly increasing values than DGA and PCC following salt application at the two lower temperatures. Optimum application rate of salt on PCC and DGA lies between 100 and 300 lb/lane mile (LM), and a higher rate resulted in slight or no improvement in friction. DGA showed anomalous results: lower friction for 300 lb/LM and higher friction for both 100 and 500 lb/LM.

CR 82-19
WASTEWATER APPLICATIONS IN FOREST ECOSYSTEMS.
McKim, H.L., et al, Aug. 1982, 22p., ADA-119 994, 38 refs.
37-462
WASTE DISPOSAL, WASTE TREATMENT, WATER TREATMENT, FOREST ECOSYSTEMS, TREES (PLANTS), GROWTH, LAND RECLAMATION, REVEGETATION, WATER POLLUTION.

Under proper design and management, a forest ecosystem in the central United States should renovate municipal wastewater as long or longer than conventional agricultural systems, especially when design limitations are hydraulic loading rate, heavy metals, P and N. Forest systems require smaller buffer zones than agricultural systems and lower sprinkler pressures. Immature forests are better wastewater renovators than mature forests.

CR 82-20
DECELERATION OF PROJECTILES IN SNOW.
Albert, D.G., et al, Aug. 1982, 29p., ADA-119 676, 11 refs.
Richmond, P.W.
39-1271
SNOW DENSITY, PENETRATION TESTS, PROJECTILE PENETRATION, MILITARY RESEARCH, VELOCITY, IMPACT STRENGTH.

Instrumented M374 projectiles were launched into snow, nylon, and Styrofoam targets using a 10.7-m radius centrifuge. For snow of 410-kg/cu m density, the 3.1-kg test projectile experienced decelerations of approximately 220, 400, and 550 m/sq s (at a depth of 0.1 m) for initial impact velocities of 15, 30 and 46 m/s respectively. These values disagree with values predicted from a simple hydrodynamic drag force approximation. The decelerations measured for snow targets were always greater than those measured for nylon shaving targets (of density 120 kg/cu m) indicating that this material is not a good analog for snow of the density used in these tests.

CR 82-21
ACOUSTIC EMISSIONS FROM POLYCRYSTALLINE ICE.
St. Lawrence, W.F., et al, Aug. 1982, 15p., ADA-119 632, 18 refs.
Cole, D.M.
37-734
ICE CRYSTAL STRUCTURE, ICE ACOUSTICS, COMPRESSIVE PROPERTIES, STATIC LOADS, FRACTURING, STRESSES, STRAINS, TEMPERATURE EFFECTS, TIME FACTOR, TESTS.

The acoustic emission response from fine-grained polycrystalline ice subjected to constant compressive loads was examined. A number of tests were conducted with the nominal stress ranging from 0.8 to 3.67 MPa at a temperature of -5 C. The acoustic emission response was recorded and the data are presented with respect to time and strain. The source of acoustic emissions in ice is considered in terms of the formation of both microfractures and visible fractures that develop without catastrophic failure of the ice. A model to describe the acoustic emission response is developed.

CR 82-22
CONDUCTION PHASE CHANGE BENEATH INSULATED HEATED OR COOLED STRUCTURES.
Lunardini, V.J., Aug. 1982, 40p., ADA-119 595, 19 refs.
39-1746
PERMAFROST BENEATH STRUCTURES, PERMAFROST HEAT TRANSFER, FREEZE THAW CYCLES, CONDUCTION, HEAT TRANSFER, PHASE TRANSFORMATIONS, UNDERGROUND PIPELINES, THERMAL INSULATION, ANALYSIS (MATHEMATICS).

The problem of thawing beneath heated structures on permafrost (or cooled structures in non-permafrost zones) must be addressed if safe engineering designs are to be conceived. In general there are no exact solutions to the problem of conduction heat transfer with phase change for practical geometries. The quasi-steady approximation is used here to solve the conductive heat transfer problem with phase change for insulated geometries including infinite strips, rectangular buildings, circular storage tanks, and buried pipes. Analytical solutions are presented and graphed for a range of parameters of practical importance.

CR 82-23
DIRECT FILTRATION OF STREAMBORNE GLACIAL SILT.
Ross, M.D., et al, Sep. 1982, 17p., ADA-120 751, 8 refs.
Lowman, R.A., Sletten, R.S.
39-1272
SEDIMENTS, GLACIAL DEPOSITS, GLACIAL RIVERS, WATER TREATMENT, GEOLOGICAL SURVEYS, EQUIPMENT.

A direct filtration, water treatment pilot plant was operated on the Kenai River at Soldotna, Alaska, during the summer of 1980. The purpose of the pilot plant operations was to determine the feasibility of the direct filtration process for removal of glacial silt. The major criterion used to determine feasibility was production of water containing less than 1.0 NTU of turbidity. For the range of raw water turbidities encountered (22-34 NTU), the pilot plant testing indicated that direct filtration was feasible and could be considered as an alternative to conventional water treatment plants containing sedimentation tanks.

CR 82-24
SUBSEA PERMAFROST IN HARRISON BAY, ALASKA: AN INTERPRETATION FROM SEISMIC DATA.
Neave, K.G., et al, Aug. 1982, 62p., ADA-121 020, 16 refs.
Sellmann, P.V.
39-1727
SUBSEA PERMAFROST, SEISMIC SURVEYS, BOTTOM SEDIMENT, SEISMIC REFRACTION, SEISMOLOGY, NATURAL RESOURCES, OCEAN BOTTOM, UNITED STATES—ALASKA—HARRISON BAY.

Velocity data derived from petroleum industry seismic records from Harrison Bay show that high-velocity material (>2km/s) interpreted to be ice-bonded permafrost is common. In the eastern part of the bay, the depth to high velocity material increases and velocity decreases in an orderly manner with increasing distance from shore until the layer is no longer apparent. The western part of the bay is less orderly, possibly reflecting a different geological and thermal history. This western part may be an inundated section of the low coastal plain characterized by the region north of Teshekpuk Lake, and could have contained deep thaw lakes, creating low velocity zones. Along some seismic lines, the high-velocity material extends approximately 25 km offshore.

CR 82-25
EXPERIMENTAL INVESTIGATION OF POTENTIAL ICING OF THE SPACE SHUTTLE EXTERNAL TANK.
Ferrick, M.G., et al, Sep. 1982, 305p., ADA-121 330.
Itagaki, K., Lemieux, G.E., Minas, S.E.
39-1712
AIRCRAFT ICING, TANKS (CONTAINERS), SPACECRAFT, PROTECTIVE COATINGS, THERMAL INSULATION, ICE FORMATION, COUNTERMEASURES, SURFACE TEMPERATURE, STATISTICAL ANALYSIS, EXPERIMENTATION.

The thermal protection system tiles on the space shuttle Orbiter are extremely sensitive to impact damage. Such impacts could be caused by ice particles dislodged from the outer surface of the external tank (ET) during the launch. The ET, which contains the cryogenic propellant tanks, is covered with a spray-on foam insulation (SOFI) to minimize ice formation. The objective of this investigation was to experimentally explore a range of environmental conditions for which significant icing potential exists for the ET. A significant finding, which became evident early in the experimental program, was that computer models based upon the average SOFI thickness predicted panel surface temperatures that were considerably higher than those observed. For an assessment of icing, the important values to characterize the SOFI are the minimum thickness and range of thickness. Dense ice formation occurred most readily when a small portion of the total surface area had a temperature below freezing.

CR 82-26
HYDROLOGY AND CLIMATOLOGY OF THE CARIBOU-POKER CREEKS RESEARCH WATERSHED, ALASKA.
Haugen, R.K., et al, Oct. 1982, 34p., ADA-122 402, Refs. p.25-28.
Slaughter, C.W., Howe, K.E., Dingman, S.L.
37-1233
WATERSHEDS, DRAINAGE, PERMAFROST HYDROLOGY, CLIMATE, RUNOFF, STREAM FLOW, PRECIPITATION (METEOROLOGY), SEASONAL VARIATIONS, UNITED STATES—ALASKA—CARIBOU CREEK.

The Caribou-Poker Creeks Research Watershed is a small drainage basin located 48 km northwest of Fairbanks, Alaska. Elevations within the watershed range from 210 to 826 m, and approximately 28% of its area is underlain by permafrost. Climatic differences between the watershed and Fairbanks are primarily due to the higher elevation of watershed. Generally the watershed climatic sites are warmer in winter and cooler in summer than Fairbanks. An analysis of annual streamflow data showed an inconsistency of baseflow recessions from year to year. The runoff-rainfall ratio for individual summer storms averaged 0.35 for Caribou Creek. Comparisons of spot discharge measurements of predominantly permafrost and non-permafrost subwatersheds showed that permafrost-dominated watersheds have a much "flashier" response to precipitation than non-permafrost watersheds. A comparison of the annual flow distribution of the watershed indicated that Caribou Creek has lower summer and higher winter discharges per unit area than the Chena or Salcha Rivers. The temporal variability of the flow of Caribou Creek is low compared with small- and moderate-sized streams in New England.

CR 82-27
LEAST LIFE-CYCLE COSTS FOR INSULATION IN ALASKA.
Flanders, S.N., et al, Oct. 1982, 47p., ADA-122 806, 6 refs.
Coutts, H.J.
37-1482
THERMAL INSULATION, BUILDINGS, COST ANALYSIS, ECONOMIC ANALYSIS, CLIMATIC FACTORS, FUELS, MILITARY FACILITIES.

Recommendations for economical thicknesses for building insulation result from a study of fuel and construction costs of 12 military installations in Alaska. A comparison between the insulation thickness that a building owner might choose today and what he might choose in 20 years indicates a trend for much thicker insulation in the future. An analysis of how much more expensive a building built today with the thickness that would be appropriate 20 years hence indicates only a small penalty in life-cycle costs for the additional insulation. Therefore, a minimum of R-32 walls and R-62 attics is recommended for most of Alaska.

CR 82-28
EVALUATION OF VAISALA'S MICROCORA AUTOMATIC SOUNDING SYSTEM.
Andeas, E.L., et al, Oct. 1982, 17p., ADB-070 011L, 17 refs.
Richter, W.A.
37-1529
MARINE METEOROLOGY, METEOROLOGICAL INSTRUMENTS, METEOROLOGICAL DATA, WIND (METEOROLOGY).

During the Weddell Polynya Expedition in the southern ocean, over 60 upper-air soundings were made with a Vaisala MicroCORA Automatic Sounding System installed on the Soviet icebreaker *Mikhail Somov*. The MicroCORA system measures the wind vector by using the Omega navaid signals to track the balloon-borne radiosonde. This windfinding is thus unaffected by any motions of the ground station, the system is easy to use, and the data seem accurate. Comparison launches, during which the Vaisala radiosonde and the sonde of another manufacturer were carried on the same balloon, indicate that the MicroCORA pressure and temperature data are also of high quality. There were problems with the MicroCORA measurement of humidity, however, because of an inordinate number of failures of the humidity sensor, the Humicap, which is prone to drift. After a unit-by-unit hardware evaluation of the components of the MicroCORA system, its expected reliability for use at sea is judged only fair; several units were poorly packaged, and servicing and repair require a high degree of technical expertise. (Auth.)

CR 82-29
GROWTH OF FACETED CRYSTALS IN A SNOW COVER.
Colbeck, S.C., Oct. 1982, 19p., ADA-122 792, 45 refs.
37-1722
SNOW CRYSTAL GROWTH, RECRYSTALLIZATION, SNOW CRUST, DEPTH HOAR, HEAT FLUX, VAPOR TRANSFER, GRAIN SIZE, THERMODYNAMICS, SNOW DENSITY, TEMPERATURE EFFECTS, TEMPERATURE GRADIENTS, SNOW COVER.

Ice grains in a snow cover with a low temperature gradient assume a well-rounded equilibrium form. However, at temperature gradients of 0.1 to 0.2C/cm (depending somewhat on temperature and snow density), the rounded grains recrystallize into a faceted kinetic growth form. The large temperature gradient must play a decisive role in moving the vapor fast enough to sustain the rapid growth rate associated with the kinetic growth form. Once the large temperature gradient is removed, the grains recrystallize back to the equilibrium form. The recrystallization occurs in either direction without a change in bulk density. The growth of faceted crystals begins at the warmer base of the snow cover where the excess vapor pressure is largest. A transition between the overlying rounded grains moves upward in time. Faceted crystals also grow just below crusts of reduced permeability, where the increased vapor accumulation can sustain the excess vapor pressure needed for kinetic growth. The heat and vapor flows are described using a model based on thermodynamic equilibrium. The temperature distribution is shown to be quasi-linear at steady state in homogeneous snow. The recrystallization of the snow is modeled using *the rounded grains as sources and the faceted grains as* sinks. In the future this model should be extended to account for different temperatures among the sources and sinks.

CR 82-30

EQUATIONS FOR DETERMINING THE GAS AND BRINE VOLUMES IN SEA ICE SAMPLES.

Cox, G.F.N., et al, Oct. 1982, 11p., ADA-122 779, 13 refs.

Weeks, W.F.

37-1723

SEA ICE, BRINES, GAS INCLUSIONS, ICE DENSITY, ICE TEMPERATURE, ICE SALINITY, *TEMPERATURE EFFECTS*, *COMPUTER* APPLICATIONS, ANALYSIS (MATHEMATICS).

Equations are developed that can be used to determine the amount of gas present in sea ice from measurements of the bulk ice density, salinity and temperature in the temperature range of -2 to -30C. Conversely these relationsips can be used to give the density of sea ice as a function of its temperature and salinity, considering both the presence of gas and of solid salts in the ice. Equations are also given that allow the calculation of the gas and brine volumes in the ice at temperatures other than that at which the bulk density was determined.

CR 82-31

BERING STRAIT SEA ICE AND THE FAIRWAY ROCK *ICEFOOT*.

Kovacs, A., et al, Oct. 1982, 40p., ADA-122 477, 45 refs.

Sodhi, D.S., Cox, G.F.N.

39-1273

ICE CONDITIONS, SEA ICE, PRESSURE RIDGES, ICE PRESSURE, ICE FORMATION, OFFSHORE LANDFORMS, ICE LOADS, GROUNDED ICE, AERIAL SURVEYS, BERING STRAIT.

Information on sea ice conditions in the Bering Strait and the icefoot formation around Fairway Rock, located in the strait, is presented. Cross-sectional profiles of Fairway Rock and the relief of the icefoot are given along with theoretical analyses of the possible forces active during icefoot formation. It is shown that the ice cover most likely fails in flexure as opposed to crushing or buckling, as the former requires less force. Field observations reveal that the Fairway Rock icefoot is massive, with ridges up to 15 m high, a seaward face only 20 deg from vertical, and interior ridge slopes averaging 33 deg. The icefoot is believed to be grounded and its width ranges from less than 10 to over 100 m.

CR 82-32

FLUID DYNAMIC ANALYSIS OF VOLCANIC TREMOR.

Ferrick, M.G., et al, Oct. 1982, 12p., ADA-122 778, 28 refs.

Qamar, A., St. Lawrence, W.F.

37-1499

FLUID DYNAMICS, SEISMOLOGY, VOLCANOES, EARTHQUAKES, ICEQUAKES, GEOMAGNETISM.

Low-frequency (< 10 Hz) volcanic earthquakes originate at a wide range of depths and occur before, during, and after magmatic eruptions. The characteristics of these earthquakes suggest that they are not typical tectonic events. Physically analogous processes occur in hydraulic fracturing of rock formations, low-frequency icequakes in temperate glaciers, and autoresonance in hydroelectric power stations. We propose that unsteady fluid flow in volcanic conduits is the common source mechanism of low-frequency volcanic earthquakes (tremor). The fluid dynamic source mechanism explains low-frequency earthquakes of arbitrary duration, magnitude, and depth of origin, as unsteady flow is independent of physical properties of the fluid and conduit. Fluid transients occur in both low-viscosity gases and high-viscosity liquids. A fluid transient analysis can be formulated as generally as is warranted by knowledge of the composition and physical properties of the fluid, material properties, geometry and roughness of the conduit, and boundary conditions.

CR 82-33

ON THE DIFFERENCES IN ABLATION SEASONS OF ARCTIC AND ANTARCTIC SEA ICE.

Andreas, E.L., et al, Oct. 1982, 9p., ADA-122 454, 41 *refs. For another source see 36-2836 (MP 1517).*

Ackley, S.F.

39-1728

SEA ICE, ICE MELTING, ABLATION, METEOROLOGICAL FACTORS, ICE CONDITIONS.

Arctic sea ice is freckled with melt ponds during the ablation season; Antarctic sea ice has *few, if any.* On the basis of a simple surface heat budget, we investigate the meteorological conditions necessary for the onset of surface melting in an attempt to explain these observations. The low relative humidity associated with the relatively dry winds off the continent and an effective radiation parameter smaller than that characteristic of the Arctic are primarily responsible for the absence of melt features in the Antarctic. Together these require a surface-layer air temperature above 0 C before Antarctic sea ice can melt. A ratio of the bulk transfer coefficients C(H)/C(E) less than 1 also contributes to the dissimilarity in Arctic and Antarctic ablation seasons. The effects of wind speed and of the sea-ice roughness on the absolute values of C(H) and C(E) seem to moderate regional differences, but final assessment of this hypothesis awaits better data, especially from the Antarctic.

CR 82-34

HYDRAULIC MODEL STUDY OF PORT HURON ICE CONTROL STRUCTURE.

Calkins, D.J., et al, Nov. 1982, 59p., ADA-123 715, 8 refs.

Deck, D.S., Sodhi, D.S.

37-2375

ICE CONTROL, HYDRAULIC STRUCTURES, ICE NAVIGATION, ICE MECHANICS, FLOATING ICE, ARTIFICIAL ICE, ICE LOADS, ICE *FLOES, DOPED ICE*, PORTS, MODELS.

The ice discharge through an opening in an ice control structure was documented to be a function of the floe size, ice type, ice floe conditions and vessel direction. The model data for the average ice discharge per vessel transit scaled to prototype values compared favorably with data taken at the *St. Marys River ice control structure (ICS).* The model results of the force measurements were also consistent with data taken at the St. Marys ICS. The dynamic loading conditions were independent of vessel direction. The dynamic loading *to the structure using* 3 types of ice (plastic, natural and urea-doped) showed a considerable difference in their means and *standard deviations.* The urea-doped ice was evaluated for dynamic loading conditions, and reasonable peak values *of 3 to 5* times the mean load at each measuring position were recorded, independent of *vessel direction.* It appears that synthetic random ice floes may be used in model studies where ice discharge *through an opening in a structure* needs to be documented. This study shows the synthetic random ice floe discharge *to fall reasonably* within the values obtained for natural ice discharge for both rafted and non-rafted ice fields above *the ICS. However, the question of whether* synthetic ice can be used for analyzing force distribution and dynamic *force loading criteria* cannot be fully answered at this time because the load distributions of the synthetic and natural floes appear to differ.

CR 82-35

CLIMATE OF REMOTE AREAS IN NORTH-CENTRAL ALASKA: 1975-1979 SUMMARY.

Haugen, R.K., Nov. 1982, 110p., ADA-123 719, 31 refs.

37-2376

CLIMATE, SNOW ACCUMULATION, PRECIPITATION (METEOROLOGY), AIR TEMPERATURE, TEMPERATURE GRADIENTS, STATISTICAL ANALYSIS, TEMPERATURE VARIATIONS, UNITED STATES—ALASKA.

Air temperature, precipitation, and some ground surface temperatures predominantly from remote areas of central and northern Alaska are statistically and graphically summarized on a monthly basis for a five-year period (1975-79). The remote site data were obtained during the course of several CRREL investigations. To provide a more comprehensive coverage, these data are presented together with data obtained at National Weather Service stations in the area. The analysis is based on four *climatic regions within the study* area: the Continental Interior, the Brooks Range, the Arctic Foothills, and the Arctic Coastal Plain. A detailed analysis of coastal-inland summer air temperature gradients on the Arctic Coastal Plain is given. Station *histories for the* 1975-79 period and tabulated air and ground temperature statistics are included as appendices.

CR 82-36

LONG-TERM MODIFICATIONS OF PERENNIALLY FROZEN SEDIMENT AND TERRAIN AT EAST OUMALIK, NORTHERN ALASKA.

Lawson, D.E., Nov. 1982, 33p., ADA-123 731, Refs. p.30-33.

37-2377

PERMAFROST THERMAL PROPERTIES, DEGRADATION, SOIL EROSION, SEDIMENTS, TUNDRA, ENVIRONMENTAL IMPACT, THERMOKARST, ACTIVE LAYER, HUMAN FACTOR ENGINEERING, UNITED STATES—ALASKA—OUMALIK.

Camp construction and drilling activities *in 1950 at* the East Oumalik drill site in northern Alaska caused extensive degradation of ice-rich, perennially frozen silt and irreversible modification of the upland terrain. In a study of the long-term degradational *effects at this site, the near-surface* geology was defined by drilling and coring 76 holes (maximum depth *of 34 m) in disturbed areas and by laboratory analyses* of these cores. Terrain disturbances, including bulldozed roads and *excavations, camp structures and off-road* vehicle trails, were found to have severely disrupted the site's thermal regime. This led *to* a thickening *of* the active layer, melting of the ground ice, thaw subsidence and thaw consolidation *of the* sediments. Slumps, sediment gravity flows and collapse of materials on slopes bounding thaw depressions expanded the degradation laterally, with thermal and hydraulic erosion removing material as the depressions widened and deepened with time. Degradational processes became less active after thawed sediments thickened sufficiently to slow the increase in the depth of thaw and permit slope stabilization. The site's terrain is now irregular and hummocky with numerous depressions. Seasonal thaw depths are deeper in disturbed areas than in undisturbed areas and reflect the new moisture conditions and morphology. The severity of disturbance is much greater at East Oumalik than at another old drill site, Fish Creek. The difference results primarily from differences in the physical properties of the sediments, including the quantity and distribution of ground ice. In areas similar to East Oumalik, the removal or severe compaction of the vegetative mat would cause similar adverse physical changes to take place over two to three decades and should therefore be avoided.

CR 82-37

LANDSAT-ASSISTED ENVIRONMENTAL MAPPING IN THE ARCTIC NATIONAL WILDLIFE REFUGE, ALASKA.

Walker, D.A., et al, Nov. 1982, 59p. + 2 maps, ADA-123 440, Refs. p.34-37.

Acevedo, W., Everett, K.R., Gaydos, L., Brown, J., Webber, P.J.

39-1274

TUNDRA, MAPPING, REMOTE SENSING, GEOBOTANICAL INTERPRETATION, ENVIRONMENTS, SOILS, PATTERNED GROUND, VEGETATION, CLASSIFICATIONS, LANDSAT, UNITED STATES—ALASKA—ARCTIC NATIONAL WILDLIFE REFUGE.

This report presents a Landsat-derived land cover map of the northwest portion of the Arctic National Wildlife Refuge, Alaska. The report is divided into two parts. The first is devoted to the land cover map with detailed descriptions of the mapping methods and legend. The second part is a description of the study area. The classification system used for the maps is an improvement over existing methods of describing tundra vegetation. It is a comprehensive method of nomenclature that consistently applies the same criteria for all vegetation units. It is applicable for large- and small-scale mapping and is suitable for describing vegetation complexes, which are common in the patterned-ground terrain of the Alaskan Arctic. The system is applicable to Landsat-derived land cover classifications. The description of the study area focuses on five primary terrain types: flat thaw-lake plains, hilly coastal plains, foothills, mountainous terrain, and river flood plains. Topography, landforms, soils and vegetation are described for each terrain type. The report also contains area summaries for the Landsat-derived map categories. The area summaries are generated for the five terrain types and for the 89 *townships within* the study areas. Two land cover maps at 1:250,000 are included.

CR 82-38

WINDOW PERFORMANCE IN EXTREME COLD.

Flanders, S.N., et al, Dec. 1982, 21p., ADA-124 571, For another version see 35-2514. 10 refs.

Buska, J., Barrett, S.

38-4415

ICING, WINDOWS, WEATHERPROOFING, MILITARY FACILITIES, THERMAL INSULATION, COLD WEATHER CONSTRUCTION, HEAT LOSS, AIR LEAKAGE, HUMIDITY, CONDENSATION, COUNTERMEASURES, COST ANALYSIS.

Extreme cold causes heavy buildup of frost, ice and condensation on many windows. It also increases the incentive for improving the airtightness of windows against heat loss. Our study shows that tightening specifications for Alaskan windows to permit only 30% of the air leakage allowed by current American airtightness standards is economically attractive. We also recommend triple glazing in much of Alaska to avoid window icing in homes and barracks. We base our conclusions on a two-year field study of Alaskan military bases that included recording humidity and temperature data, observing moisture accumulation on windows and measuring airtightness with a fan pressurization device.

CR 82-39
BRINE ZONE IN THE MCMURDO ICE SHELF, ANTARCTICA.
Kovacs, A., et al, Dec. 1982, 28p., ADA-124 516, 29 refs.
Gow, A.J., Cragin, J.H., Morey, R.M.
37-3355
ICE SHELVES, BRINES, ICE SALINITY, ANTARCTICA—MCMURDO ICE SHELF.

A 4.4-m-high brine step in McMurdo Ice Shelf has migrated about 1.2 km in 4 years. This migration is proof of the dynamic nature of the step, which is the leading edge of a brine wave that originated at the shelf edge after a major break-out of the McMurdo Ice Shelf. The inland boundary of brine penetration is characterized by a series of descending steps that are believed to represent terminal positions of separate intrusions of brine of similar origin. The inland boundary of brine percolation is probably controlled largely by the depth at which brine encounters the firn/ice transition (43m). However, this boundary is not fixed by permeability considerations alone, since measurable movement of brine is still occurring at the inland boundary. Freeze-fractionation of the seawater as it migrates through the ice shelf preferentially precipitates virtually all sodium sulfate, and concomitant removal of water by freezing in all pore spaces of the infiltrated firn produces residual brines approximately six times more concentrated than the original seawater. (Auth.)

CR 82-40
BREAKING ICE WITH EXPLOSIVES.
Mellor, M., Dec. 1982, 64p., ADA-123 761, 25 refs.
37-2378
ICE BREAKING, ICE BLASTING, EXPLOSIVES, EXPLOSION EFFECTS, UNDERWATER EXPLOSIONS, ICE COVER THICKNESS, STATISTICAL ANLYSIS, COMPUTER APPLICATIONS, ANALYSIS (MATHEAMTICS), DESIGN.

The use of explosives to break floating ice sheets is described, and test data are used to develop curves that predict explosives effects as ice thickness, charge size, and charge depth vary. Application of the curves to practical problems is illustrated by numerical examples. The general features of underwater explosions are reviewed and related to ice blasting. Quasi-static plate theory is considered, and is judged to be inapplicable to explosive cratering of ice plates. The specific energy for optimized ice blasting is found to compare quite favorably with the specific energy of icebreaking ships. All available field data for ice blasting are tabulated in appendices, together with details of the regression analyses from which the design curves are generated.

CR 82-41
EVALUATION OF PROCEDURES FOR DETERMINING SELECTED AQUIFER PARAMETERS.
Daly, C.J., Dec. 1982, 104p., ADA-125 437, Refs. p.93-104.
37-3496
GROUND WATER, WATER FLOW, HYDROLOGY, PERMEABILITY, WATER POLLUTION, POROSITY, TESTS.

Many of the important factors influencing the choice of appropriate aquifer test procedures are presented. The concepts of bias, accuracy and spatial variability are explained. The definitions of a number of aquifer parameters are developed from basic principles demonstrating the underlying assumptions and limitations. The parameters considered are: piezometric head, hydraulic conductivity/intrinsic permeability, flow direction, specific discharge magnitude, transmissivity, volumetric flow rate, total porosity, effective porosity, average linear velocity, storage coefficient, specific yield, dispersion coefficient-aquifer dispersivity. For each parameter several techniques are described, evaluated and ranked in terms of perceived potential accuracy, simplicity and value to contaminant transport studies. It must be stressed, however, that the evaluations are based principally upon theoretical grounds, and not upon actual conduct of the desribed procedures.

CR 82-42
EFFECTS OF CONDUCTIVITY OF HIGH-RESOLUTION IMPULSE RADAR SOUNDING, ROSS ICE SHELF, ANTARCTICA.
Morey, R.M., et al, Dec. 1982, 12p., ADA-124 456, 16 refs.
Kovacs, A.
37-3354
RADAR ECHOES, ELECTRONIC EQUIPMENT, ICE COVER THICKNESS, OCEAN CURRENTS, ANTARCTICA—ROSS ICE SHELF.

The system was evaluated to detect sea ice on the bottom of the Ross Ice Shelf, detect the preferred horizontal c-axis azimuthal direction of the sea ice crystals and determine the direction of the currents under an Antarctic ice shelf. Surface radar survey on the Ross Ice Shelf at Site J-9 and surface and airborne radar profiling on the McMurdo Ice Shelf were made. The CRREL impulse radar system was unable to detect the shelf bottom at Site J-9, which drilling revealed to be 416 m below the snow surface. The radar system was used to profile the McMurdo Ice Shelf both from the snow surface and from the air; a shelf thickness of about 275 m was easily detected. The bulk conductivity of the ice shelf at Site J-9 was higher than originally anticipated, and this limited the radar sounding depth to about 405 m when operating at a frequency of 20 MHz. (Auth. mod.)

CR 82-44
CASE STUDY OF LAND TREATMENT IN A COLD CLIMATE—WEST DOVER, VERMONT.
Bouzoun, J.R., et al, Dec. 1982, 96p., ADA-125 438, 42 refs. Collection of two articles.
Meals, D.W., Cassell, E.A.
37-3494
ICE FORMATION, WASTE TREATMENT, WATER TREATMENT, SNOW ACCUMULATION, LAND RECLAMATION, COLD WEATHER PERFORMANCE, GROUND WATER, WATER PIPELINES, HYDROLOGY, NUTRIENT CYCLE, SURFACE WATER.

A slow rate land treatment system that operates throughout the year in a very cold climate is described in detail. Information on the geology, soils, vegetation, wildlife and the climate at the site is also presented. Winter operational problems such as ice formation on the elevated spray laterals, and freezing and plugging of the spray nozzles are discussed, as are their solutions. The detailed results of a 1-year study to characterize the seasonal performance of the system, to develop N and P budgets for the system, to monitor specific hydrologic events on the spray field, to monitor shallow groundwater quality, to monitor the groundwater quality in off-site wells, and to monitor the water quality of two rivers that border the site are presented. Recommendations for the design and operation of other slow rate land treatment systems to be constructed in cold climates are included.

CR 83-01
ANALYSIS OF ROOF SNOW LOAD CASE STUDIES; UNIFORM LOADS.
O'Rourke, M., et al, Jan. 1983, 29p., ADA-126 330, 12 refs.
Koch, P., Redfield, R.
37-3351
ROOFS, BUILDING CODES, SLOPE ORIENTATION, DESIGN, STATISTICAL ANALYSIS.

Roof snow load case studies gathered throughout the United States over a three-year period are analyzed. The objective of the analysis is to determine a relationship between the snow load on the ground and the corresponding uniform snow load on flat and sloped roofs. The main parameters considered are the thermal characteritics of the roof, the roof slope and the exposure of the structure. Exposure has the strongest effect on the ratio of ground to roof snow loads. Comparisons are made with existing and proposed building codes and standards.

CR 83-02
COMPUTER MODELING OF TIME-DEPENDENT RIME ICING IN THE ATMOSPHERE.
Lozowski, E.P., et al, Jan. 1983, 74p., ADA-126 404, 19 refs.
Oleskiw, M.M.
37-3497
AIRCRAFT ICING, ICE ACCRETION, TIME FACTOR, ICE FORMATION, COMPUTERIZED SIMULATION, HELICOPTERS, MATHEMATICAL MODELS.

A numerical model of rime ice accretion on an arbitrary two-dimensional airfoil is presented. The physics of the model are described and results are presented that demonstrate, by comparison with other theoretical data and experimental data, that the model predictions are believable. Results are also presented that illustrate the capability of the model to handle time-dependent rime ice accretion, taking into account the feedback between the ice accretion and the airflow and droplet trajectory fields.

CR 83-03
ASSESSMENT OF THE TREATABILITY OF TOXIC ORGANICS BY OVERLAND FLOW.
Jenkins, T.F., et al, Jan. 1983, 47p., ADA-126 384, Refs. p.28-30.
Leggett, D.C., Parker, L.V., Oliphant, J.L., Martel, C.J., Foley, B.T., Diener, C.J.
37-3498
WASTE TREATMENT, WATER TREATMENT, LAND RECLAMATION, TEMPERATURE EFFECTS, SLOPES, WATER POLLUTION, ABSORPTION, WATER FLOW.

The removal efficiency for 13 trace organics in wastewater was studied on an outdoor, prototype overland flow land treatment system. The removal for each of these substances was greater that 94% at an application rate of 0.4 cm/hr. The percent removals declined as application rates were increased. The rate of removal from solution was described by the sum of two mass-transport-limited, first-order rate coefficients representing volatilization and sorption. A model based on the two-film theory was developed; the observed removal rate coefficients were regressed against three properties of each substance: the Henry's constant, the octanol-water partition coefficient and the molecular weight. The dependence of the removal process on temperature was studied and is included along with average water depth in the model. The decrease in removal rate as temperature declined is supported by the known dependence of Henry's constant and diffusivity on temperature. The model was validated on a second overland flow system. The surface soil concentrations of the trace organics determined at the end of the experiment suggest that a secondary mechanism renews the surface activity rapidly enough so that contaminants do not build up on the surface, with the possible exception of PCB. Biodegradation is suggested as the predominant secondary mechanism rather than volatilization because substances less volatile than PCB were not found at the end of the experiment.

CR 83-04
ICE GROWTH ON POST POND, 1973-1982.
Gow, A.J., et al, Feb. 1983, 25p., ADA-126 334, 15 refs.
Govoni, J.W.
40-4676
ICE GROWTH, ICE DETERIORATION, PONDS, SNOW ICE, ICE COVER THICKNESS, METEOROLOGICAL FACTORS, SEASONAL VARIATIONS, ICE MODELS, DEGREE DAYS, STEFAN PROBLEM, UNITED STATES—NEW HAMPSHIRE—POST POND.

Measurements and analysis of seasonal ice growth and decay on Post Pond, New Hamsphire, for the period 1973-1982 are presented. Observations included ice thickness measurements, examination of the various ice types contributing to the ice cover, and measurements of meteorological parameters for correlation with and modeling of the ice growth process. The overall nature of ice growth and decay (ice loss) on Post Pond has been ascertained, the seasonal variability in the timing of freeze-up and ice-out and the duration of the ice cover have been determined, and the relationship of ice growth to freezing-degree-day records evaluated on the basis of a Stefan conduction equation modified to deal with ice sheets covered with or free of snow. Ice growth occurs predominantly by the direct freezing of lake water, but snow ice may compose as much as 50% of the ice cover in winters with higher than average snowfall. Freeze-up leading to the establishment of a stable ice cover occurs during the 4-week period from the end of November to the end of December. Maximum seasonal ice thicknesses were from 45 to 67 cm and are generally attained during the first two weeks of March; ice-out, marking the final disappearance of ice from Post Pond, usually occurs by the third week of April. The overall rate of ice loss is three to four times that of ice growth, and is dominated initially by melting from the top. As much as 50% of the ice may be lost in this way before the onset of any bottom melting. Final dissipation of the ice cover is usually expedited by candling resulting from preferential melting and disintegration of the ice at crystal boundaries.

CR 83-05
DYNAMIC ICE-STRUCTURE INTERACTION DURING CONTINUOUS CRUSHING.
Määttänen, M., Feb. 1983, 48p., ADA-126 349, 22 refs.
37-3441
ICE SOLID INTERFACE, OFFSHORE STRUCTURES, PILE STRUCTURES, ICE PRESSURE, DYNAMIC LOADS, ICE LOADS, VELOCITY, TESTS.

This report presents the results of dynamic ice-structure interaction model tests conducted at the CRREL Ice Engineering Facility. A flexible, single-pile, bottom-founded offshore structure was simulated by a test pile with about a one-to-ten scale ratio. Urea (instead of sodium chloride) was used as dopant to scale down the ice properties, resulting in good model ice properties. Six ice fields were frozen and 18 tests carried out. In all cases distinctive dynamic ice-structure interaction vibrations appeared, from which abundant data were collected. In tests with linear ice velocity sweep, sawtooth-shaped ice force fluctuations occurred first. With increasing velocity the natural modes of the test pile were excited, and shifts from one mode to another occurred. The maximum ice force values appeared mostly with low loading rates, but high forces appeared randomly at high ice velocities. As a general trend, ice force maximums, averages and standard deviations decreased with increasing ice velocities. The aspect ratio effect of the ice force in coninuous crushing follows the same dependence as in static loadings. The frequency of observed ice forces is strongly dominated by the natural modes of the structure. Dynamically unstable natural modes tend to make the developing ice force frequencies the same as the natural frequencies.

CR 83-06
CHEMICAL FRACTIONATION OF BRINE IN THE MCMURDO ICE SHELF, ANTARCTICA.
Cragin, J.H., et al, Mar. 1983, 16p., ADA-127 821, 23 refs.
Gow, A.J., Kovacs, A.
38-688
ICE CORES, ICE SALINITY, ICE COMPOSITION, ICE SHELVES, ICE PHYSICS, ANTARCTICA—MCMURDO SOUND.

During the austral summers of 1976-77 and 1978-79, several ice cores were taken from the McMurdo Ice Shelf brine zone to investigate its thermal, physical and chemical properties. Chemical analyses of brine samples from the youngest (uppermost) brine wave show that it contains sea salts in normal seawater proportions. Further inland, deeper and older brine layers, though slightly highly saline (S > 200%), are severely depleted in (S04)2-/Na+ ratio being an order of magnitude less than that of normal seawater. Analyses of Na+, K+, Ca2+, Mg2+, (So4)2- and Cl-, together with solubility and temperature considerations, show that the sulfate depletion is due to selective precipitation of mirabilite, Na2S041OH2O. The location of the inland boundary of brine penetration is closely related to the depth at which the brine encounters the firn/ice transition. However, a small but measurable migration of brine is still occurring in otherwise impermeable ice; this is attributed to eutectic dissolution of the ice by concentrated brine as it moves into deeper and warmer parts of the McMurdo Ice Shelf. (Auth.)

CR 83-07

ANALYSIS OF DIFFUSION WAVE FLOW ROUTING MODEL WITH APPLICATION TO FLOW IN TAILWATERS.

Ferrick, M.G., et al, Mar. 1983, 31p., ADA-128 142, 18 refs.

Bilmes, J., Long, S.E.

39-1252

DAMS, WATER FLOW, WATER WAVES, HYDROLOGY, RIVER FLOW, FLOW MEASUREMENT, MATHEMATICAL MODELS, DIFFUSION.

Peak power generation with hydropower creates tailwater flow conditions characterized by high and low flows with abrupt transitions between these states. Flows occurring in tailwaters typically form sharp-fronted, large-amplitude waves of relatively short period. An understanding of the mechanics of downstream propagation of these waves is important both for direct application in studies of the tailwater and because of the similarity of these waves to those following a dam break. An analysis of the dynamic equations of open channel flow is used to quantify the relative importance of flow wave convection, diffusion and dispersion in rivers. The relative importance of each process is related to the relative magnitude of terms in the dynamic equations, providing a physical basis for model formulation. A one-dimensional diffusion wave flow routing model, modified for tailwaters, simulates the important physical processes affecting the flow and is straightforward to apply. The model is based upon a numerical solution of the kinematic wave equation.

CR 83-08

PROPERTIES OF UREA-DOPED ICE IN THE CRREL TEST BASIN.

Hirayama, K., Mar. 1983, 44p., ADA-128 219, 34 refs.

38-4416

DOPED ICE, UREA, ICE STRENGTH, ICE COVER THICKNESS, ICE MECHANICS, HYDRAULICS, FLEXURAL STRENGTH, ICE MODELS, AIR TEMPERATURE, TESTS.

In the course of model tests with urea-doped ice in the CRREL Ice Engineering Facility test basin, the growth process and the physical and mechanical properties of the model ice were investigated. The parameters which were varied were: urea concentration in the tank water, air temperature during growth, growth duration, and tempering time. Uniformity of ice thickness and ice mechanical properties over the whole tank area were found to be satisfactory. The structure of the urea-doped ice was found to be similar to that of the ice except for a relatively thick incubation layer over a dendritic bottom layer. Empirical relationships were established between: ice thickness and negative degree-hours; mechanical properties and growth temperature, urea concentration, and ice thickness; and reduction in mechanical properties and tempering time. The results of the study are presented in charts which permit reliable scheduling of model tests with required ice thickness and ice flexural strength.

CR 83-09

SHORE ICE RIDE-UP AND PILE-UP FEATURES. PART 1: ALASKA'S BEAUFORT SEA COAST.

Kovacs, A., Mar. 1983, 51p., ADA-127 198, 24 refs.

38-394

FAST ICE, ICE PILEUP, ICE OVERRIDE, SEA ICE, SHORES, SHORELINE MODIFICATION, BEACHES, BEAUFORT SEA.

Recent observations of shore ice pile-up and ride-up along the coast of the Alaska Beaufort Sea are presented. Information is given to show that sea ice movement on shore has overridden steep coastal bluffs and has thrust inland over 150 m, gouging into and pushing up mounds of beach sand, gravel, boulders and peat and, inland, the tundra material. The resulting ice scar morphology was found to remain for tens of years. Onshore ice movements up to 20 m are relatively common, but those over 100 m are very infrequent. Spring is a dangerous time, when sea ice melts away from the shore, allowing ice to move freely. Under this condition, driving stresses of less than 100 kPa can push thick sea ice onto the land.

CR 83-10

COMPUTER MODELS FOR TWO-DIMENSIONAL STEADY-STATE HEAT CONDUCTION.

Albert, M.R., et al, Apr. 1983, 90p., ADA-128 793, 8 refs.

Phetteplace, G.E.

38-543

PERMAFROST HEAT TRANSFER, PERMAFROST PHYSICS, FROST ACTION, THERMAL CONDUCTIVITY, UNDERGROUND PIPELINES, BOUNDARY LAYER, COMPUTER PROGRAMS, MATHEMATICAL MODELS.

This report outlines the development and verification of two computer models of two-dimensional steady-state heat conduction including a variety of boundary conditions. One is a finite difference program and the other is a finite element program. The results of each program are compared to two analytic solutions, and to one another.

CR 83-11

RADAR PROFILING OF BURIED REFLECTORS AND THE GROUNDWATER TABLE.

Sellmann, P.V., et al, Apr. 1983, 16p., ADA-130 225, 17 refs.

Arcone, S.A., Delaney, A.J.

38-544

RADAR ECHOES, SEASONAL FREEZE THAW, WATER TABLE, SUBSURFACE INVESTIGATIONS, PROFILES, GROUND WATER, SOIL FREEZING, GROUND THAWING.

Investigations of ground radar performance over thawed and seasonally frozen silts, and sands and gravels containing artificial and natural reflectors were carried out in Alaska. The radar emitted 5-10 ns pulses, the center frequency of which was approximately 150 MHz. The artificial reflectors were metal sheets and discs and the natural reflectors were the groundwater table and interfaces between frozen and thawed material.

CR 83-12

COMPUTER MODELS FOR TWO-DIMENSIONAL TRANSIENT HEAT CONDUCTION.

Albert, M.R., Apr. 1983, 66p., ADA-134 893, 9 refs.

38-877

HEAT TRANSFER, FREEZE THAW CYCLES, HEAT PIPES, HEATING, MATHEMATICAL MODELS, COMPUTERIZED SIMULATION, PHASE TRANSFORMATIONS.

This paper documents the development and verification of two finite difference models that solve the general two-dimensional form of the heat conduction equation, using the alternative-direction implicit method. Both can handle convective, constant flux, specified temperature and semi-infinite boundaries. The conducting medium may be composed of many materials. The first program, ADI, solves for the case where no change of state occurs. ADIPC solves for the case where a freeze/thaw change of phase may occur, using the apparent heat capacity method. Both models are verified by comparison to analytical results.

CR 83-13

REVIEW OF THE PROPAGATION OF INELASTIC PRESSURE WAVES IN SNOW.

Albert, D.G., Apr. 1983, 26p., ADA-128 714, 35 refs.

38-4417

SNOW ELASTICITY, EXPLOSIVES, WAVE PROPAGATION, PRESSURE, ELASTIC WAVES, DETONATION WAVES, TESTS.

A review on past experimental and theoretical work indicates a need for additional experimentation to characterize the response of snow to inelastic pressure waves. Pressure data from previously conducted explosion tests are analyzed to estimate the elastic limit of snow of 400 kg/cu m density to be about 36 kPa. This pressure corresponds to a scaled distance of 1.6 m/kg exp 1/3 for charges fired beneath the surface of the snow, and to a scaled distance of 1.2 m/kg exp 1/3 for charges fired in the air. The effects of a snow cover on the method of clearing a minefield by using an explosive charge fired in the air above the snow surface are also discussed and recommendations are given for further work in this area. Explosive pressure data are used to estimate the maximum effective scaled radius for detonating buried mines at shallow depth to be 0.8 kg exp 1/3. Fuel-air explosive will increase this effective radius significantly because of the increase in the size of the source region.

CR 83-14

STUDY ON THE TENSILE STRENGTH OF ICE AS A FUNCTION OF GRAIN SIZE.

Currier, J.H., et al, May 1983, 38p., ADA-134 889, 30 refs.

Schulson, E.M., St. Lawrence, W.F.

38-2189

ICE CRYSTAL STRUCTURE, TENSILE PROPERTIES, ICE STRENGTH, ICE CRACKS, GRAIN SIZE, ICE DEFORMATION, COMPRESSIVE PROPERTIES, BRITTLENESS, FRACTURING.

An analysis of ice fracture that incorporates dislocation mechanics and linear elastic fracture mechanics is discussed. The derived relationships predict a brittle to ductile transition in polycrystalline ice under tension with a Hall-Petch type dependence of brittle fracture strength on grain size. A uniaxial tensile testing technique, including specimen preparation and loading system design was developed and employed to verify the model. The tensile strength of ice in purely brittle fracture was found to vary with the square root of the reciprocal of grain size, supporting the relationship that the theory suggests. The inherent strength of the ice lattice and the Hall-Petch slope are evaluated and findings discussed in relation to previous results. Monitoring of acoustic emissions was incorporated in the tests, providing insights into the process of microfracture during ice deformation.

CR 83-15

LAKE WATER INTAKES UNDER ICING CONDITIONS.

Dean, A.M., Jr., May 1983, 7p., ADA-128 757, 52 refs.

38-4418

WATER INTAKES, ICE CONDITIONS, ICE PREVENTION, LAKE WATER, ICE MECHANICS, DESIGN CRITERIA, ICING.

An intake may be restricted or clogged by active frazil, passive frazil, brash, or a combination of these ice forms. The exact nature of the interactions among the intake structure, the ice and the hydraulic and meteorological conditions that lead to icing problems is extremely site-specific. The better these parameters are quantified, the more tailored and economical the solution. A defense against these ice forms may be formulated in four areas: the origin of the ice, the transportation mechanics of the ice, the accumulation characteristics of the ice, and the form of the ice when it is in the area of influence of the intake. To produce a lake intake structure that minimizes or eliminates icing problems, one may devise an unconstrained or a constrained design. To evaluate solutions to icing problems and/or to supplement incomplete data, a scale-model investigation is recommended. A universal, unconstrained solution would be extremely expensive. The more data available through site monitoring and model studies, the better the problem (and therefore the solution) can be bracketed. This paper provides guidance for developing a site-specific solution.

CR 83-16

DEVELOPING A MODEL FOR PREDICTING SNOWPACK PARAMETERS AFFECTING VEHICLE MOBILITY.

Berger, R.H., May 1983, 26p., ADA-134 878, Refs. p.23-26.

38-878

SNOW COVER EFFECT, TRAFFICABILITY, VEHICLES, SNOW DEPTH, SNOW DENSITY, SNOW ACCUMULATION, ABLATION, TEMPERATURE EFFECTS, MODELS.

The presence of snow on the ground can impose limitations on the mobility of wheeled and tracked vehicles. Snow depth and density are the two most easily measured snow properties that can be related to mobility over snow. Existing models of snowpack accumulation and ablation processes and models of internal snowpack structure were examined to determine if a model of the snowpack can be developed for use in predicting the snow parameters that affect mobility. Simple models, such as temperature index models, do not provide sufficient snowpack details, and the more detailed models required too many measured inputs. Components of the various models were selected from a basis of a snowpack model for predicting snow properties related to mobility over snow. Methods of obtaining the input data for some components are suggested, and areas where more development is needed are described.

CR 83-17

COMPARISON OF SEA ICE MODEL RESULTS USING THREE DIFFERENT WIND FORCING FIELDS.

Tucker, W.B., June 1983, 11p., ADA-134 462, 11 refs.

38-879

ICE MODELS, SEA ICE, WIND PRESSURE, ICE MECHANICS, ATMOSPHERIC PRESSURE, ICE COVER THICKNESS.

A sea ice model was applied to the East Greenland Sea to examine a 60-day ice advance period beginning 1 October 1979. This investigation compares model results using driving geostrophic wind fields derived from three sources. Winds calculated from sea-level pressures obtained from the National Weather Service's operational analysis system resulted in strong velocities concentrated in a narrow band adjacent to the Greenland coast, with moderate velocities elsewhere. The model showed excessive ice transport and thickness build-ups in the coastal region. The extreme pressure gradient parallel to the coast resulted partially from a pressure reduction procedure that was applied to the terrain-following sigma coordinate system to obtain sea-level pressures. Additional sea-level pressure fields were obtained from an independent optimal interpolation analysis that merged FGGE buoys drifting in the Arctic basin with high latitude land stations and from manual digitization of the NWS hand-analyzed Northern Hemisphere Surface Charts. Modeling results using winds derived from both of these fields agreed favorably.

CR 83-18

DETECTION OF CAVITIES UNDER CONCRETE PAVEMENT.

Kovacs, A., et al, July 1983, 41p., ADA-131 851, 10 refs.
Morey, R.M.
38-470

CONCRETE PAVEMENTS, CAVITATION, RADAR ECHOES, DETECTION, CRACKING (FRACTURING), PROFILES.

An evaluation of an impulse radar system for detecting cavities under concrete pavement is discussed, and field results are presented. It was found that a dual antenna mode of surveying was ideal for void detection. In this mode one antenna operated in a transceive mode and a second, offset from the first, operated in a receive-only mode. This arrangement allowed a refraction-type profile survey to be performed, which enabled subpavement voids to be easily detected. Field trials were held at Plattsburgh Air Force Base, where 28 cavities were detected and mapped. Drilling of holes verified that a cavity existed and allowed cavity depth to be measured. The cavities varied from 1.5 in. to 23 in. in depth and were up to 20 ft long.

CR 83-19

ICE FORCES ON MODEL BRIDGE PIERS.

Haynes, F.D., et al, July 1983, 11p., ADA-133 082, 20 refs.
Sodhi, D.S., Kato, K., Hirayama, K.
38-395

ICE PRESSURE, ICE LOADS, ICE SOLID INTERFACE, ICE PUSH, ICE MECHANICS, BRIDGES, PIERS, ICE STRENGTH, MODELS, FLEXURAL STRENGTH, TESTS.

Small-scale laboratory experiments were conducted on model bridge piers in the CRREL test basin. The experiments were performed by pushing model ice sheets against structures and monitoring the ice forces during the ice/structure interaction. The parameters, varied during the test program, were the geometry of the bridge piers and the velocity, thickness, and flexural strength of the ice. The results are presented in the form of ice forces on sloping and vertical structures with different geometries. During ice action on sloping structures, a phenomenon of transition of failure mode from bending to crushing was observed as the ice velocity was steadily increased.

CR 83-20

LAND TREATMENT RESEARCH AND DEVELOPMENT PROGRAM: SYNTHESIS OF RESEARCH RESULTS.

Iskandar, I.K., et al, Aug. 1983, 144p., ADA-134 540, Refs. p.63-124.
Wright, E.A.
38-4419

WASTE TREATMENT, WATER TREATMENT, SANITARY ENGINEERING, LAND RECLAMATION, DESIGN CRITERIA, RESEARCH PROJECTS.

The major objective of the Corps of Engineers Land Treatment Research and Development Program was to provide, through research, definitive criteria and procedures to enable the cost-effective and environmentally safe use of land treatment of municipal wastewater. This research included long-term field experiments at different locations within the United States to establish design criteria, laboratory research to understand and solve fundamental problems, and evaluation of existing land treatment systems to document long-term performance. The information gathered from the land treatment research program has been published in more than 240 technical publications on regional planning, site selection, design procedures, mechanisms of wastewater renovation, site management, site monitoring and environmental effects. During the land treatment program an active technology transfer effort was maintained to transmit research results directly to users. The LTRP clearly demonstrated that land treatment is an attractive alternative to other waste treatment practices. It was also shown that the direct benefits of the program, in terms of increased cost-effectiveness from improved design, were much greater than the program's cost.

CR 83-21

STATISTICAL ASPECTS OF ICE GOUGING ON THE ALASKAN SHELF OF THE BEAUFORT SEA.

Weeks, W.F., et al, Sep. 1983, 34p. + map, ADA-134 428, Refs. p.32-34.
Barnes, P.W., Rearic, D.M., Reimnitz, E.
38-880

ICE SCORING, OCEAN BOTTOM, BOTTOM TOPOGRAPHY, OFFSHORE DRILLING, OFFSHORE STRUCTURES, SEA ICE, STATISTICAL ANALYSIS, BEAUFORT SEA.

The statistical characteristics of ice-produced gouges in the sea floor along a 190-km stretch of the Alaskan coast of the Beaufort Sea between Smith Bay and Camden Bay are studied, based on 1500 km of precision fathometry and side-looking sonar records that were obtained between 1972 and 1979 in water depths to 38 m. The probability density function of the gouge depths into the sediment is represented by a simple negative exponential over four decades of gouge frequency. The deepest gouge observed was 3.6 m, from a sample of 20,354 gouges that have depths greater than or equal to 0.2 m. The dominant gouge orientations are usually unimodal and reasonably clustered, with the most frequent alignments roughly parallel to the general trend of the coastline. The value of the mean number of gouges (deeper than 0.2 m) per kilometer measured normal to the trend of the gouges, varies from 0.2 for protected lagoons to 80 in water between 20 and 38 m deep in unprotected offshore regions. The distribution of the spacings between gouges as measured along a sampling track is a negative exponential. The form of the frequency distribution of the mean number of gouges varies with water depth and is exponential for lagoons and shallow offshore areas, positively skewed for 10 to 20 m depths off the barrier islands, and near-normal for deeper water. As a Poisson distribution gives a reasonable fit to the mean number of gouges distributions for all water depths, it is suggested that gouging can be taken as approximating a Poisson process in both space and time. The distributions of the largest values per kilometer of gouge depths, gouge widths, and heights of the lateral embankments of sediments plowed from the gouges are also investigated. Limited data on gouging rates give an average of 5 gouges per kilometer per year. Examples are given of the application of the data set to hypothetical design problems associated with the production of oil from areas in the Alaskan portion of the Beaufort Sea.

CR 83-22

TRANSPORT OF WATER IN FROZEN SOIL. 1. EXPERIMENTAL DETERMINATION OF SOIL-WATER DIFFUSIVITY UNDER ISOTHERMAL CONDITIONS.

Nakano, Y., et al, Aug. 1983, 8p., ADA-135 419, For another source see 37-4218. 13 refs.
Tice, A.R., Oliphant, J.L., Jenkins, T.F.
38-4462

FROZEN GROUND MECHANICS, SOIL WATER MIGRATION, FROST HEAVE, UNFROZEN WATER CONTENT, SOIL MECHANICS, WATER TRANSPORT, ANALYSIS (MATHEMATICS), EXPERIMENTATION.

A new experimental method for measuring the soil-water diffusivity of frozen soil under isothermal conditions is introduced. The theoretical justification of the method is presented and the feasibility of the method is demonstrated by experiments conducted using marine-deposited clay. The measured values of the soil-water diffusivity are found comparable to reported experimental data.

CR 83-23

STRESS MEASUREMENTS IN ICE.

Cox, G.F.N., et al, Aug. 1983, 31p., ADA-133 906, 29 refs.
Johnson, J.B.
38-4463

ICE PHYSICS, STRESSES, LOADS (FORCES), ICE CREEP, ICE ELASTICITY, MEASURING INSTRUMENTS, ANALYSIS (MATHEMATICS), TESTS.

The problems associated with measuring stresses in ice are reviewed. Theory and laboratory test results are then presented for a stiff cylindrical sensor made of steel that is designed to measure ice stresses in a biaxial stress field. Loading tests on freshwater and saline ice blocks containing the biaxial ice stress sensor indicate that the sensor has a resolution of 20 kPa and an accuracy of better than 15% under a variety of uniaxial and biaxial loading conditions. Principal stress directions can also be determined within 5 deg. The biaxial ice stress sensor is not significantly affected by variations in the ice elastic modulus, ice creep or differential thermal expansion between the ice and guage. The sensor also has a low temperature sensitivity (5 kPa degC).

CR 83-24

SENSITIVITY OF PLANT COMMUNITIES AND SOIL FLORA TO SEAWATER SPILLS, PRUDHOE BAY, ALASKA.

Simmons, C.L., et al, Sep. 1983, 35p., ADA-136 619, 22 refs.
Everett, K.R., Walker, D.A., Linkins, A.E., Webber, P.J.
38-4464

TUNDRA, VEGETATION, SEA WATER, POLLUTION, ENVIRONMENTAL IMPACT, WATER TREATMENT, SALT WATER, SOIL WATER, SOIL MICROBIOLOGY, ROOTS, DAMAGE.

Secondary recovery of oil at Prudhoe Bay, Alaska, will involve transporting large quantities of seawater in elevated pipelines across tundra for injection into oil-bearing rock strata. The possibility of a pipeline rupture raises questions concerning the effects of seawater on tundra vegetation and soils. To evaluate the relative sensitivities of different plant communities to seawater, eight sites representing the range of vegetation types along the pipeline route were treated with single, saturating applications of seawater during the summer of 1980. Live (green) bryophyte cover was markedly reduced in the moist experimental sites in 1981. Bryophytes in all but one of the wet-site experimental plots were apparently unaffected by the seawater treatment. Two species of foliose lichens treated with seawater showed marked deterioration in 1981. All other lichen taxa were apparently unaffected by the seawater treatment. On spill sites, microbial-related soil respiration and hydrolysis of cellulose and organic phosphorus were significantly reduced, as were soil enzymes and viable microbial biomass, for up to one year after treatment. Ectomycorrhizal roots of *Salix* on the treated plots showed a significant reduction in viable biomass, number of mycorrhizal roots, and respiration rates of the viable roots.

CR 83-25

ICE ACTION ON PAIRS OF CYLINDRICAL AND CONICAL STRUCTURES.

Kato, K., et al, Sep. 1983, 35p., ADA-134 595, 22 refs.
Sodhi, D.S.
38-881

BRIDGES, PIERS, ICE LOADS, OFFSHORE STRUCTURES, ICE PRESSURE, ICE SOLID INTERFACE, COMPRESSIVE PROPERTIES, FLEXURAL STRENGTH, TESTS.

Ice action on two cylindrical and conical structures, located side by side, has been investigated in a small-scale experimental study to determine the interference effects on the ice forces generated during ice-structure interaction. The proximity of the two structures changes the mode of ice failure, the magnitude and direction of ice forces on the individual structure, and the dominant frequency of ice force variations. Interference effects were determined by comparing the experimental results of tests at different structure spacings.

CR 83-26

MECHANICAL ICE RELEASE PROCESSES. 1. SELF-SHEDDING FROM HIGH-SPEED ROTORS.

Itagaki, K., Oct. 1983, 8p., ADA-135 369, 19 refs.
38-4465

ICE REMOVAL, PROPELLERS, ICING, ICE ACCRETION, SUPERCOOLED FOG, ICE FORMATION, ICE ADHESION, ICE STRENGTH, ICE CONTROL, TENSILE PROPERTIES, ANALYSIS (MATHEMATICS).

Ice accreted on high-speed rotors operating in supercooled fog can be thrown off by centrifugal force, creating severe unbalance and dangerous projectiles. A simple force balance analysis indicates that the strength of accreted ice and its adhesive strength can be obtained by measuring the thickness of the accretion, the location of the separation, the rotor speed and the density. Such an analysis was applied to field and laboratory observations of self-shedding events. The results agree reasonably well with other observations.

CR 83-27

DRIVING TRACTION ON ICE WITH ALL-SEASON AND MUD-AND-SNOW RADIAL TIRES.

Blaisdell, G.L., Nov. 1983, 22p., ADA-136 115, 9 refs.
38-2555

RUBBER ICE FRICTION, TRACTION, TIRES, RUBBER SNOW FRICTION, ICE TEMPERATURE, ADHESION, DESIGN.

This study reports on a comparison of the driving traction performance on ice of a selected group of all-season radial tires with mud-and-snow radial tires. In addition to performance variation due to tread design, the effects of tire inflation pressure and ice temperature are explored. The results indicate that no significant tractive advantage on ice can be attributed to tread design. The contribution of tire tread to traction on ice is completely overshadowed by adhesion between the ice and the compound which makes up the tire's contact surface. Based on adhesion, a slight favoring of all-season tires is found. Increasing ice temperature generally decreased the tractive capability of a specific tire. For several tires, however, the opposite was true. Reduced inflation pressure also caused a slight decrease in the tractive performance parameters calculated.

CR 83-28

LONG-TERM PLANT PERSISTENCE AND RESTORATION OF ACIDIC DREDGE SOILS WITH SEWAGE SLUDGE AND LIME.

Palazzo, A.J., Dec. 1983, 11p., ADA-137 451, 31 refs.
38-1658

DREDGING, SOIL CHEMISTRY, SEWAGE TREATMENT, REVEGETATION, LIMING, SLUDGES, LAND RECLAMATION, GRASSES.

A field study was conducted to determine whether sewage sludge and lime could be useful as soil amendments on acidic (pH 2.4) and infertile dredged spoils and to evaluate grasses that may be suitable for restoring acidic dredged spoils. Applications of dolomitic limestone in combination with sewage sludge or commercial fertilizer and topsoil improved soil fertility and produced a better overall growth environment at the site. Metal concentrations resulting from sludge applications increased but not to excessive levels. Movement of metals below the 20-cm depth was noted for the extractible forms of zinc, copper and nickel. A total of 29 grass treatments, containing grasses seeded alone or in combinations and receiving the sludge/lime treatment, were evaluated over a seven-year period, and selected grasses were analyzed for mineral composition. All grass species showed good establishment on the amended acidic spoil.

CR 83-29

EROSION OF PERENNIALLY FROZEN STREAMBANKS.

Lawson, D.E., Dec. 1983, 22p., ADA-138 410, Refs. p.14-17.

38-4466

SHORE EROSION, PERMAFROST THERMAL PROPERTIES, BANKS (WATERWAYS), FROZEN GROUND STRENGTH, SOIL EROSION, STABILITY, GULLIES, SHORELINE MODIFICATION, STREAMS, TEMPERATURE EFFECTS, HYDRAULICS.

A literature review indicated that the effects of permafrost on streambank erodibility and stability are not yet understood because systematic and quantitative measurements are seriously lacking. Consequently, general controversy exists as to whether perennially frozen ground inhibits lateral erosion and bankline recession, or whether it increases bank recession rates. Perennially frozen streambanks erode because of modification of the bank's thermal regime by exposure to air and water, and because of various erosional processes. Factors that determine rates and locations of erosion include physical, thermal and structural properties of bank sediments, stream hydraulics and climate. Thermal and physical modification of streambanks may also induce accelerated erosion within permafrost terrain removed from the immediate river environment. Bankline or bluffline recession rates are highly variable, ranging from less than 1 m/year to over 30 m/year and, exceptionally, to over 60 m/year. Long-term observations of the physical and thermal erosion processes and systematic ground surveys and measurements of bankline-bluffline recession rates are needed.

CR 83-30

ICE SHEET RETENTION STRUCTURES.

Perham, R.E., Dec. 1983, 33p., ADA-138 030, Refs. p.27-29.

38-4467

ICE CONTROL, ICE BOOMS, STABILIZATION, ICE SHEETS, ICE COVER, FRAZIL ICE.

Ice sheets are formed and retained in several ways in nature, and an understanding of these factors is needed before most structures can be successfully applied. Many ice sheet retention structures float and are somewhat flexible; others are fixed and rigid or semirigid. An example of the former is the Lake Erie ice boom and of the latter, the Montreal ice control structure. Ice sheet retention technology is changing. The use of timber cribs is gradually but not totally giving way to sheet steel pilings and concrete cells. New structures and applications are being tried but with caution. Ice-hydraulic analyses are helpful in predicting the effects of structures and channel modifications on ice cover formation and retention. Often, varying the flow rate in a particular system at the proper time will make the difference between whether a structure will or will not retain ice. The structure, however, invariably adds reliability to the sheet ice retention process.

CR 83-31

MECHANICS OF ICE JAM FORMATION IN RIVERS.

Ackermann, N.L., et al, Dec. 1983, 14p., ADA-138 371, For another version see 36-3281. 12 refs.

Shen, H.T.

38-4468

ICE JAMS, ICE FORMATION, ICE MECHANICS, RIVER ICE, RIVER FLOW, HYDRAULICS, ICE CROSSINGS, COMPUTER PROGRAMS, MATHEMATICAL MODELS.

A mathematical model is described that is used to determine the maximum ice conveyance capacity of a river channel. Based upon this model, computer programs were developed that enable the ice discharge to be calculated for steady-state flow conditions. For rivers that have uniform flow, the maximum ice-conveying capacity can be described with a simple function expressed in terms of the size of the ice fragments, channel geometry, and the flow of water in the river. For nonuniform flows, the computer program determines the elevation profile of the surface layer in addition to other flow characteristics, such as the velocity and surface concentration of the ice fragments. The location along this surface profile where the ice conveyance capacity becomes less than the upstream supply is determined and is considered to be the position where a surface ice jam or ice bridge will be formed.

CR 83-32

ICE FORCE MEASUREMENTS ON A BRIDGE PIER IN THE OTTAUQUECHEE RIVER, VERMONT.

Sodhi, D.S., et al, Dec. 1983, 6p., ADA-139 425, 2 refs.

Kato, K., Haynes, F.D.

38-4469

ICE LOADS, ICE FLOES, PIERS, BRIDGES, ICE PRESSURE, RIVER ICE, WATER LEVEL, ICE STRENGTH, ICE MECHANICS.

Ice forces on a bridge pier in the Ottauquechee River, in Quechee, Vermont, were measured by installing four panels—each capable of measuring forces in the normal and tangential direction—on both sides of a vertical V-shaped pier nose. The measured forces are presented for a short period during an ice run. After the ice run, the thickness and sizes of the ice floes were measured and the compressive strength of the ice was determined in the laboratory from the ice samples collected along the river banks. The water level measurements made at several locations along the river are also presented for the period of the ice run.

CR 83-33

THERMODYNAMIC MODEL OF CREEP AT CONSTANT STRESSES AND CONSTANT STRAIN RATES.

Fish, A.M., Dec. 1983, 18p., ADA-139 883, Refs. p.16-18.

38-4470

SOIL CREEP, FROZEN GROUND THERMODYNAMICS, FROZEN GROUND MECHANICS, ICE MECHANICS, STRESSES, STRAINS, RHEOLOGY, MATHEMATICAL MODELS.

A thermodynamic model has been developed that for the first time describes the entire creep process, including primary, secondary, and tertiary creep, and failure for both constant stress (CS) tests and constant strain rate (CSR) tests, in the form of a unified constitutive equation and unified failure criteria. Deformation and failure are considered as a single thermoactivated process in which the dominant role belongs to the change of entropy. Failure occurs when the entropy change is zero. At the moment the strain rates in CS tests reach the minima and stress in CSR tests reaches the maximum (peak) values. Families of creep and stress-strain curves, obtained from uniaxial compression CS and CSR tests of frozen soil, respectively (both presented in dimensionless coordinates), are plotted as straight lines and are superposed, confirming the unity of the deformation and failure process and the validity of the model. A method is developed for determining the parameters of the model, so that creep deformation and the stress-strain relationship of ductile materials such as soils can be predicted based upon information obtained from either type of test.

CR 84-01

TOWARD IN-SITU BUILDING R-VALUE MEASUREMENT.

Flanders, S.N., et al, Jan. 1984, 13p., ADA-139 917, 8 refs.

Marshall, S.J.

38-4471

THERMAL CONDUCTIVITY, BUILDINGS, THERMAL INSULATION, WALLS, HEAT FLUX, TEMPERATURE MEASUREMENT, INFRARED PHOTOGRAPHY, ACCURACY.

A technique for measuring the thermal resistance (R-value) of large areas of building envelope is under development. It employs infrared thermography to locate radiant temperature extremes on a building surface and to provide a map of normalized temperature values for interpolation between locations. Contact thermal sensors (thermocouples for temperature and thermopiles for heat flow) are used to calculate the R-value at specific locations by summing the output from each sensor until the ratio between temperature difference from inside to outside surface and heat flow converges to a constant value. R-value measurements of a wood frame insulated wall were within 13% of the expected theoretical value. Similar measurements of a masonry wall were 31 and 43% less than expected. Experimentation demonstrated that a large ratio between temperature difference was the single most important variable affecting accuracy and speed of convergence. Thermal guards around heat flow sensors were of little value, according to both experimentation and computer simulation. Attempts to match the absorptivity of sensors with their surroundings may have been insufficient to diminish about 10% of the remaining error in measurement. Lateral heat flow and convection may have been significant problems for accuracy in the masonry construction. Currently, an investigator cannot rely on the literature for guidance in assessing the limitations on accuracy for in-situ building R-value measurement.

CR 84-02

ELECTROMAGNETIC PROPERTIES OF SEA ICE.

Morey, R.M., et al, Jan. 1984, 32p., ADA-140 330, 26 refs.

Kovacs, A., Cox, G.F.N.

38-4472

ICE ELECTRICAL PROPERTIES, SEA ICE, ELECTROMAGNETIC PROPERTIES, DIELECTRIC PROPERTIES, ELECTRICAL RESISTIVITY, ICE SPECTROSCOPY, ICE CRYSTAL STRUCTURE, ANISOTROPY, BRINES.

Investigations of the in situ complex dielectric constant of sea ice were made using time-domain spectroscopy. It was found that (1) for sea ice with a preferred horizontal crystal c-axis alignment, the anisotropy or polarizing properties of the ice increased with depth, (2) brine inclusion conductivity increased with decreasing temperature down to about -8 C, at which point the conductivity decreased with decreasing temperature, (3) the DC conductivity of sea ice increased with increasing brine volume, (4) the real part of the complex dielectric constant is strongly dependent upon brine volume but less dependent upon the brine inclusion orientation, (5) the imaginary part of the complex dielectric constant was strongly dependent upon brine inclusion orientation but much less dependent upon brine volume. Because the electromagnetic (EM) properties of sea ice are dependent upon the physical state of the ice, which is continually changing, it appears that only trends in the relationships between the EM properties of natural sea ice and its brine volume and brine inclusion microstructure can be established.

CR 84-03

MODEL TESTS ON TWO MODELS OF WTGB 140-FOOT ICEBREAKER.

Tatinclaux, J.C., Jan. 1984, 17p., ADA-139 882, 10 refs.

38-4473

ICEBREAKERS, ICE COVER STRENGTH, ICE CONDITIONS, ICE BREAKING, UREA, DOPED ICE, MODELS.

The results of resistance tests in level ice and broken ice channels are presented for two models of the WTGB 140-ft icebreaker at scales of 1:10 and 1:24, respectively. No scale effect on the resistance in level ice could be detected between the two models. From the test results an empirical predictor equation for the full scale ice resistance is derived. Predicted resistance is compared against, and found to be 25 to 40% larger than, available full-scale values estimated from thrust measurements during full-scale trials of the Great Lakes icebreaker *Katmai Bay*.

CR 84-04

EFFECTIVENESS AND INFLUENCES OF THE NAVIGATION ICE BOOMS ON THE ST. MARYS.

Perham, R.E., Jan. 1984, 12p., ADA-139 908, 8 refs.

38-4474

ICE NAVIGATION, ICE BOOMS, RIVER ICE, ICE BREAKING, ICE CONTROL, ICE BREAKUP, ICE MECHANICS, ICE COVER THICKNESS.

Ice problems developed in the Sault Ste. Marie, Michigan, portion of the St. Marys River because of winter navigation. Passing ships and natural influences moved ice from Soo Harbor into Little Rapids Cut in sufficient quantities to jam, cause high water in the harbor, and prevent further ship passage. After physical model and engineering studies, two ice booms with a total span of 1375 ft (419 m) with a 250-ft (76-m) navigation opening between were installed at the head of Little Rapids Cut in 1975. A modest field study program on the booms was conducted for the ensuing four winters to determine ice and boom interaction and the effects of ship passages on the system. Forces on some anchors were recorded and supplemental data were taken by local personnel. Several reports have been written about the booms' early operations. This paper presents a four-year summary of the main effects of the boom on ice and ship interaction and vice versa. Throughout the four winter seasons, the small quantities of ice lost over and between the booms were manageable. Ships usually passed through the boom without influencing the boom force levels, but at times they brought about large changes. One boom needed strengthening, and artificial islands were added for upstream ice stability. Coast Guard icebreakers were also a necessary part of winter navigation in this area.

CR 84-05

MORPHOLOGY AND ECOLOGY OF DIATOMS IN SEA ICE FROM THE WEDDELL SEA.

Clarke, D.B., et al, Feb. 1984, 41p., ADA-141 994, Refs. p.12-14.

Ackley, S.F., Kumai, M.

38-4501

ICE COMPOSITION, ALGAE, PACK ICE, SEA ICE, PLANKTON, ICE CORES, ICE COVER THICKNESS, ICE SALINITY, ECOLOGY, CLASSIFICATIONS, WEDDELL SEA.

Diatom species composition and relative abundances were determined for ice cores obtained from Weddell Sea pack ice during the October-November 1981 Weddell Polynya expedition (WEPOLEX). Ice thickness and salinity indicate that the ice was less than one year old. The predominant ice type (70%) was frazil, which has the capacity to mechanically incorporate biological material through nucleation and scavenging. Diatoms were found throughout the length of the cores. Species showed down-core fluctuations in abundance that appeared to be correlated with changes in ice type. Pennate forms were more abundant than centrics, the average ratio being 16:1. Diatom frustules with intact organic material were more abundant (50 million cells/liter). Differences in species abundances are attributed initially to incorporation of algal cells from a temporally changing water column and subsequently to diatom reproduction within the ice. Scanning electron micrographs illustrating the morphologic characteristics of the predominant species are included.

CR 84-06

AEROSOL GROWTH IN A COLD ENVIRONMENT.

Yen, Y.-C., Feb. 1984, 21p., ADA-139 907, 4 refs.

38-4475

AEROSOLS, GROWTH, HEAT TRANSFER, MASS TRANSFER, VAPOR DIFFUSION, COLD WEATHER TESTS, ANALYSIS (MATHEMATICS), DROPS (LIQUIDS), TEMPERATURE EFFECTS.

An expression relating aerosol growth to cold environmental conditions was developed. This was accomplished by solving the diffusion equation with the method of Laplace transformation. The series solution was expressed in terms of the ratio of vapor density over droplet surface to droplet density, ratio of environmental vapor density at time zero to vapor density over droplet surface, and ratio of product of diffusion coefficient and time to square of initial radius of condensation nucleus. To take into account the variation of the vapor density over the surface of an acidic condensation nucleus due to the continuous dilution of the droplet, the solution was obtained by assuming various levels of constant vapor concentration.

CR 84-07

FORCE DISTRIBUTION IN A FRAGMENTED ICE COVER.

Stewart, D.M., et al, Mar. 1984, 16p., ADA-142 100, 10 refs.

Daly, S.F.

38-4476

ICE FLOES, SHEAR STRESS, FLOATING ICE, LOADS (FORCES), ICE BOOMS, ICE LOADS, RIVER ICE, ICE COVER THICKNESS, SHORES, EXPERIMENTATION.

Experiments were conducted in CRREL's refrigerated flume facility to examine the two-dimensional force distribution of a floating, fragmented ice cover restrained by a boom in a simulated river channel. To determine the force distribution, a vertically walled channel, instrumented for measuring normal and tangential forces, and an instrumented restraining boom were installed in a 40.0- by 1.3-m flume. Two sizes of polyethylene blocks and two similar sizes of freshwater ice blocks were tested using water velocities ranging from 10 to 30 cm/s. The forces measured at the instrumented boom leveled off with increasing cover length. The contribution of the increasing shear forces developed along the shorelines to this leveling off in the data was clearly evident. The shear coefficients of the polyethylene blocks averaged 0.43, and the freshwater ice averaged 0.044. The normal force measured along the instrumented shoreline could not be related simply by a K coefficient to the longitudinal force; another expression was required, with a term being a function of the cover thickness and independent of the undercover shear stress or cover length. By adding this term, good agreement was then found between the measured and predicted values of the boom forces and the shoreline normal and shear forces.

CR 84-08

MECHANICAL PROPERTIES OF MULTI-YEAR SEA ICE. TESTING TECHNIQUES.

Mellor, M., et al, Apr. 1984, 39p., ADA-144 431, 17 refs.

Cox, G.F.N., Bosworth, H.

39-382

ICE MECHANICS, SEA ICE, STATIC LOADS, COMPRESSIVE PROPERTIES, TENSILE PROPERTIES, EQUIPMENT, ICE SAMPLING, TESTS.

This report describes the equipment and procedures that were used for acquiring, preparing and testing samples of multi-year sea ice. Techniques and procedures are discussed for testing ice samples in compression and tension at constant strain rates and constant loads, as well as in a conventional triaxial cell. A detailed account is given of the application and measurement of forces and displacements on the ice test specimens under these different loading conditions.

CR 84-09

MECHANICAL PROPERTIES OF MULTI-YEAR SEA ICE. PHASE 1: TEST RESULTS.

Cox, G.F.N., et al, Apr. 1984, 105p., ADA-144 132, 21 refs.

Richter-Menge, J.A., Weeks, W.F., Mellor, M., Bosworth, H.

39-98

ICE MECHANICS, SEA ICE, PRESSURE RIDGES, ICE STRENGTH, COMPRESSIVE PROPERTIES, TENSILE PROPERTIES, STATIC LOADS, ICE PHYSICS, ICE SAMPLING, ICE FLOES, STATISTICAL ANALYSIS.

This report presents the results of the first phase of a test program designed to obtain a comprehensive understanding of the mechanical properties of multi-year sea ice from the Alaskan Beaufort Sea. In Phase I, 222 constant-strain-rate uniaxial compression tests were performed on ice samples from ten multi-year pressure ridges to examine the magnitude and variation of ice strength within and between pressure ridges. A limited number of constant-strain-rate compression and tension tests, constant-load compression tests, and conventional triaxial tests were also performed on ice samples from a multi-year floe to provide preliminary data for developing ice yield criteria and constitutive laws for multi-year sea ice. Data are presented on the strength, failure strain, and modulus of multi-year sea ice under different loading conditions. The statistical variation of ice strength within and between pressure ridges is examined, as well as the effects of ice temperature, porosity, structure, strain rate and confining pressure on the mechanical properties of multi-year sea ice.

CR 84-10

MODELING TWO-DIMENSIONAL FREEZING USING TRANSFINITE MAPPINGS AND A MOVING-MESH FINITE ELEMENT TECHNIQUE.

Albert, M.R., May 1984, 45p., ADA-144 131, 29 refs.

39-383

FREEZING, PHASE TRANSFORMATIONS, HEAT TRANSFER, BOUNDARY VALUE PROBLEMS, MATHEMATICAL MODELS, LATENT HEAT.

Freezing phase change problems in conduction heat transfer represent a set of moving boundary problems for which much interest currently exists. In the work presented here, two-dimensional freezing is modeled by incorporating the use of transfinite mappings with a moving-mesh finite element technique. The use of transfinite mapping in governing interior mesh motion is shown to provide very acceptable results and is demonstrated to be the most efficient general computational technique used to date. The model developed is capable of using either Cartesian or (r,z) cylindrical coordinates. Both frozen and unfrozen phases may be modeled when conduction governs behavior in both. In the case of freezing of a fluid as it flows through a pipe the usefulness of always having the phase boundary coincident with element boundaries is demonstrated. Results of the model are shown to compare well with analytical and experimental results. A von Neumann stability analysis is performed for the numerical solution and tends to support the observation that the occurrence of a high Peclet number in the moving-mesh model of heat conduction may produce distortions of the numerical solution.

CR 84-11

SEA ICE DATA BUOYS IN THE WEDDELL SEA.

Ackley, S.F., et al, May 1984, 18p., ADA-144 953, 6 refs.

Holt, E.T.

39-384

SEA ICE DISTRIBUTION, PACK ICE, DRIFT, WEATHER OBSERVATIONS, DRIFT STATIONS, ATMOSPHERIC PRESSURE, AIR TEMPERATURE, ANTARCTICA—WEDDELL SEA.

Data obtained from two sets of data buoys either air-dropped or deployed by ship onto the Weddell Sea pack ice during the period from Dec 1978 to Nov 1980 are presented. The buoy data include position, pressure and temperature information and to date represent the most complete combined weather and pack ice drift records for the ice-covered southern ocean regions. The buoys tended to drift north initially and then to turn east generally between latitudes 62 S and 64 S. Buoy 1433 turned east farther south at approximately 67 S but at about the same time as buoy 0527, implying that the westerly wind belt was farther south than usual in 1979. The range of air pressures—from about 950 mb to about 1020 mb—is typical of the circumpolar low pressure trough in the Southern Hemisphere. All buoys were equipped with an internal or compartment temperature sensor. The buoys also contained an external air temperature sensor in a ventilated, shielded can at 1-m height. Although differences of 10 C or more between recorded air and compartment temperatures are common, the correlation between the two measured temperatures is generally very good. The compartment temperatures are higher probably because the buoy is radiationally heated. We found that subtracting 3 C from the average daily compartment temperature yielded a good estimate of the average air temperature for any given day. This technique can be used to construct average daily air temperature records for the 1979 buoys which only contained the internal or compartment temperature sensor.

CR 84-12

ICING RATE ON STATIONARY STRUCTURES UNDER MARINE CONDITIONS.

Itagaki, K., June 1984, 9p., ADA-145 797, 7 refs.

39-385

ICING, OFFSHORE STRUCTURES, ICE FORMATION, OFFSHORE DRILLING, SHIP ICING, SEA SPRAY, WIND VELOCITY, ANALYSIS (MATHEMATICS).

The rate of ice accumulation on stationary structures was calculated using published data. The results were compared with icing measured on board ships. Although the general trend of this calculation indicated parallelism with the onboard measurements, the measured ice accumulation rate on ships needed a 5 to 8 m/s higher windspeed to correspond with the calculated rate for stationary structures.

CR 84-13

NITROGEN REMOVAL IN WASTEWATER PONDS.

Reed, S.C., June 1984, 26p., ADA-144 971, 26 refs.

39-386

WASTE TREATMENT, ICE COVER EFFECT, WATER TREATMENT, SANITARY ENGINEERING, PONDS, CHEMICAL ANALYSIS, MATHEMATICAL MODELS.

Nitrogen removal from wastewater can be required in a number of situations, and many military facilities have been or will be retrofitted for this purpose. Treatment lagoons and holding or storage ponds are a common treatment method or a common component in many systems. Qualitative observations over several decades document nitrogen losses from these systems due to a variety of possible biochemical interactions. This analysis is based on an extensive body of quantitative data recently published by the U.S. EPA. A mathematical model was developed and validated that indicated that nitrogen removal from pond systems is dependent on pH, temperature, and detention time. The specific biochemical factors could not be isolated, but the analysis suggests that volatilization of ammonia is the major pathway for nitrogen loss. The model can be used as a design equation for new facilities, for retrofits, and for land treatment systems with storage ponds, since nitrogen is a critical design parameter in these cases.

CR 84-14

EFFECTS OF LOW TEMPERATURES ON THE GROWTH AND UNFROZEN WATER CONTENT OF AN AQUATIC PLANT.

Palazzo, A.J., et al, June 1984, 8p., ADA-147 107, 24 refs.

Tice, A.R., Oliphant, J.L., Graham, J.M.

39-804

PLANT TISSUES, TEMPERATURE EFFECTS, UNFROZEN WATER CONTENT, COLD TOLERANCE, LOW TEMPERATURE TESTS, GROWTH, DAMAGE, NUCLAR MAGNETIC RESONANCE, AQUATIC PLANTS.

Two laboratory studies were performed to investigate the effects of low temperatures on the aquatic plant *Ceratophyllum dimersum* L. Whole plants were subjected to low-temperature treatments of +4, 0 and -6C for 48 hours, and regrowth was compared to an untreated control. The control and +4C-treated plants gained weight, while visible injury and reductions in plant biomass were noted 30 days after treatment at the two lower temperatures. The -6C treatment killed the plants, while the 0C treatment injured them to some degree. In another phase of this study, nuclear magnetic resonance (NMR) analysis of plant buds, leaves and stems showed that lowering temperatures caused the plants' unfrozen water content to drop rapidly as the temperature approached -5C, then slowly as temperatures approached -13C. From -13C to -22C there was little change in unfrozen water content. The results show that ice in this plant causes injury that affects subsequent regrowth; temperatures of -6C or below can actually kill them. This killing temperature was also near the point where frozen water content increased only slightly with lower temperatures. NMR analysis could be one way of determining plant tolerance to cold. It appears from this study that this weedy species is susceptible to low-temperature injury, and subjecting this plant to cold may be a promising method of weed control in northern lakes.

CR 84-15

BASELINE ACIDITY OF ANCIENT PRECIPITATION FROM THE SOUTH POLE.

Cragin, J.H., et al, June 1984, 7p., *ADA-145* 007, 33 refs.

Giovinetto, M.B., Gow, A.J.

39-387

ICE COMPOSITION, ICE CORES, DRILL CORE ANALYSIS, PRECIPITATION (METEOROLOGY), CHEMICAL PROPERTIES, FIRN, PALEOCLIMATOLOGY, ANTARCTICA—AMUNDSEN-SCOTT STATION.

Measurements of meltwater pH from annual layers of South Pole firn and ice samples ranging in age from 40 to 2000 years B.P. show that precipitation at this remote site has a higher natural acidity than that expected from atmospheric equilibrium with CO2. The average pH of deaerated (CO2-free) samples was 5.64, while air-equilibrated samples averaged 5.37, a pH that is about a factor of two more acidic than the expected background pH of 5.65. The observed "excess" acidity can be accounted for by natural SO4 and NO3 ion levels in the samples probably originating from non-anthropogenic H2SO4 and HNO3. Because of the presence of these naturally occurring acids in South Pole precipitation, a pH of 5.4 is considered a more representative baseline reference pH for acid precipitation studies.

CR 84-16

EFFECTS OF SOLUBLE SALTS ON THE UNFROZEN WATER CONTENTS OF THE LANZHOU, P.R.C., SILT.

Tice, A.R., et al, June 1984, 18p., ADA-152 825, 24 refs.

Zhu, Y., Oliphant, J.L.

39-2916

UNFROZEN WATER CONTENT, SALINE SOILS, LOESS, SOIL WATER, SOLUBILITY, TEMPERATURE EFFECTS, ELECTRICAL RESISTIVITY.

Phase composition curves are presented for a typical saline silt from Lanzhou, P.R.C., and compared to some silts from Alaska. The unfrozen water content of the Chinese silt is much higher than that of the Alaskan silts due to the large amount of soluble salts present in the silts from China, which are not present in silt from interior Alaska. When the salt is removed, the unfrozen water content is then similar for both the Chinese and Alaskan silt. Here we introduce a technique for correcting the unfrozen water content of partially frozen soils due to high salt concentrations. We calculate the equivalent molality of the salts in the unfrozen water at various temperatures from a measurement of the electrical conductivity of the extract from saturated paste.

CR 84-17

PULSE TRANSMISSION THROUGH FROZEN SILT.

Arcone, S.A., July 1984, 9p., ADA-147 108, 19 refs.
39-803

FROZEN GROUND PHYSICS, RADIO WAVES, WAVE PROPAGATION, PERMAFROST PHYSICS, RADAR, TEMPERATURE EFFECTS.

VHF-band radiowave short pulses were transmitted within the permafrost tunnel at Fox, Alaska, over distances between 2.2 and 10.5 m. The propagation medium was a frozen silt containing both disseminated and massive ice with temperatures varying from -7C near the transmitter to probably -2C near the center of the tunnel overburden. The short pulses underwent practically no dispersion in the coldest zones but did disperse and refract through the warmer overburden, as suggested by calculations of the effective dielectric constant. Most significantly the measured frequency content decreased as the effective dielectric constant increased. The results indicate that deep, cross-borehole pulse transmissions over distances greater than 10 m might be possible, especially when the ground is no warmer than -4C. The information thus gained could be used for identifying major subsurface variations, including ground ice features.

CR 84-18

FRAZIL ICE FORMATION.

Ettema, R., et al, July 1984, 44p., ADA-147 425, 34 refs.
Karim, M.F., Kennedy, J.F.
40-3413

FRAZIL ICE, ICE FORMATION, HEAT TRANSFER, PARTICLE SIZE DISTRIBUTION, MATHEMATICAL MODELS, TESTS, TURBULENT FLOW, WATER TEMPERATURE, COMPUTER PROGRAMS, SUPERCOOLING.

This report investigates the influences of turbulence and water temperature on frazil ice formation. The rate and the quantity of frazil ice formed in a specified volume of supercooled water increase with both increasing turbulence intensity and decreasing water temperature. The influence of turbulence intensity on the rate of frazil ice formation, however, is more pronounced for larger initial supercooling. The turbulence characteristics of a flow affect the rate of frazil ice formation by governing the temperature to which the flow can be supercooled by influencing heat transfer from the frazil ice to surrounding water, and by promoting collision nucleation, particle and floc rupture and increasing the number of nucleation sites. Larger frazil ice particles formed in water supercooled to lower temperatures. The particles usually were disks, with diameters several orders greater than their thickness. Particle size generally decreased with increasing turbulence intensity. This report develops an analytical model, in which the rate of frazil ice formation is related to temperature rise of a turbulent volume of water from the release of latent heat of fusion of liquid water to ice. Experiments conducted in a turbulence jar with a heated, vertically oscillating grid served both to guide and to calibrate the analytical model as well as to afford insights into frazil ice formation. The formation of frazil ice was studied for temperatures of supercooled water ranging from -0.9 to -0.05 C.

CR 84-19

FORECASTING WATER TEMPERATURE DECLINE AND FREEZE-UP IN RIVERS.

Shen, H.T., et al, July 1984, 17p., ADA-147 068, 14 refs.
Foltyn, E.P., Daly, S.F.
39-802

ICE FORMATION, RIVER ICE, WATER TEMPERATURE, FREEZEUP, LONG RANGE FORECASTING, COMPUTER PROGRAMS.

In this study a method for making long-range forecasts of freeze-up dates in rivers is developed. The method requires the initial water temperature at an upstream station, the long-range air temperature forecast, the predicted mean flow velocity in the river reach, and water temperature response parameters. The water temperature response parameters can be either estimated from the surface heat exchange coefficient and the average flow depth or determined empirically from recorded air and water temperature data. The method is applied to the St. Lawrence River between Kingston, Ontario, and Massena, New York, and is shown to be capable of accurately forecasting freeze-up.

CR 84-20

CHANGE IN ORIENTATION OF ARTILLERY-DELIVERED ANTI-TANK MINES IN SNOW.

Bigl, S.R., Aug. 1984, 20p., ADA-090 946, 5 refs.
39-2917

MILITARY OPERATION, TANKS (COMBAT VEHICLES), SNOW COVER EFFECT, ORIENTATION, TEMPERATURE EFFECTS, TESTS.

The Remote Anti-Armor Mine System (RAAMS) employs scatterable mines that are delivered by ejection from a projectile during flight. A problem with delivery of RAAMS mines in snow arises because a percentage of them are equipped with an anti-disturbance mechanism. The natural disturbance or tilting of the mines while melting into the snow on a warm or sunny day may cause them to detonate. Five tests lasting 3 hours to 5 days were conducted at CRREL to study change in orientation of RAAMS mines after landing in snow. Mines were set in the snow at various repose angles and their orientations were recorded periodically. The tests indicated that a critical angle of approximately 65 deg from horizontal divides the settlement patterns of the mines. Those with initial repose angles below 65 deg will tend towards 0 deg, while more steeply dipping mines will most often come to rest in a vertical position. Angular change rates during midday hours (0900-1500) ranged from 0 deg to 10 deg per hour. On sunny days with near-freezing temperatures, most mines had a total one-day change of 10 deg to 25 deg. From these tests, it appears that many of the mines would have detonated if they had been equipped with an anti-disturbance mechanism.

CR 84-21

IMPACT OF DREDGING ON WATER QUALITY AT KEWAUNEE HARBOR, WISCONSIN.

Iskandar, I.K., et al, Aug. 1984, 16p., ADA-148 321, 16 refs.
Cragin, J.H., Parker, L.V., Jenkins, T.F.
40-3546

DREDGING, SEDIMENTS, WASTE DISPOSAL, WATER POLLUTION, LACUSTRINE DEPOSITS, WATER CHEMISTRY, PORTS, UNITED STATES—WISCONSIN—KEWAUNEE.

Six sediments and four water samples were collected from Kewaunee, Wisconsin, in 1981, prior to dredging of this Lake Michigan harbor. A modified elutrate test was used to estimate potential impact on water quality upon harbor dredging and disposal of the sediments in a confined facility. The modification of the test included a comparison between containment release under aerated vs unaerated conditions and filtered vs unfiltered elutrates. Statistical analysis showed that the differences in the chemical characteristics between the filtered and unfiltered samples were significant for soluble reactive P and all the tested metals except Cu. Significant but low amounts of heavy metals (Cd, Pb, Zn, Ni, Fe, Mn) and soluble reactive P will be released to the water if the effluent is not filtered. Under aerated conditions, COD in both the filtered and unfiltered samples was higher than under unaerated conditions. In contrast, total organic carbon was much higher under the unaerated condition than under aerated conditions. The study concluded that sediment and contaminant releases from the confined disposal facility (CDF) to the harbor water were less than those from the Kewaunee River input. Also, retention of effluent in the CDF for about four days decreased the suspended solids in the effluent to about 40 to 50 mg/L, which is similar to the concentration in the lake water. The use of sand filters should not be for routine operation but rather for emergency cases when there is not enough time for effluent retention in this CDF.

CR 84-22

REGIONAL AND SEASONAL VARIATIONS IN SNOW-COVER DENSITY IN THE U.S.S.R.

Bilello, M.A., Aug. 1984, 70p., ADA-148 429, Refs. p.55-58.
39-1140

SNOW COVER DISTRIBUTION, SNOW DENSITY, SNOW SURVEYS, SNOW DEPTH, TOPOGRAPHIC EFFECTS, GEOGRAPHY, SEASONAL VARIATIONS, WIND VELOCITY, FOREST CANOPY, MAPPING, USSR.

Regional and seasonal variations in snow-cover density (SCD) in the U.S.S.R. were determined through the analysis of data obtained from all available Soviet literature. A relationship found between observed winter wind speeds and SCD values recorded from November through March made it possible to develop a snow-density map of the U.S.S.R. The map was divided into five general categories of SCD, ranging from values less than or equal to 0.21 g/cu cm at interior stations with very light winds to values greater than or equal to 0.31 g/cu cm at arctic locations with strong winds. Since this literature survey indicated that the reported Soviet SCD values were incorrect due to instrumental errors, adjustments to the data in this study were required. Month-to-month investigation of the SCD data revealed a gradual increase in density from November to March and that the SCD values under forest canopies averaged from 4 to 14% lower than those recorded in open areas. Also included in this report are 1) a compilation of pertinent passages in the Soviet literature on SCD, 2) a map showing the location of SCD measurements, and 3) an average winter wind speed chart for the U.S.S.R.

CR 84-23

EFFECT OF SNOW ON VEHICLE-GENERATED SEISMIC SIGNATURES.

Albert, D.G., Aug. 1984, 24P., ADB-090 976, 10 refs.
40-3544

MILITARY OPERATION, SNOW COVER EFFECT, SEISMOLOGY, DETECTION, VEHICLES, ATTENTUATION, ACOUSTICS, SEASONAL VARIATIONS.

Vehicle-generated seismograms recorded under summer and winter conditions at Fort Devens, Massachusetts, are analyzed and compared. The data were recorded using three-component geophones located just beneath the ground surface and microphones mounted on tripods 0.3 m tall. Winter data were recorded when a 0.7-m-thick snow cover was present. The filtering effect of this snow cover on the seismic data was striking. The appearance and frequency content of the recorded ground motion changed dramatically from summer to winter because snow attenuates the acoustic-to-seismic coupled energy. These changes were verified by magnitude-squared coherence analysis and by a simple Wiener prediction model. Automatic vehicle classification algorithms will have to account for these effects if the algorithms are to operate successfully in the presence of snow.

CR 84-24

CRYSTALLINE STRUCTURE OF UREA ICE SHEETS USED IN MODELING EXPERIMENTS IN THE CRREL TEST BASIN.

Gow, A.J., Sep. 1984, 48p., ADA-148 434, 29 refs.
39-1141

ICE CRYSTAL STRUCTURE, UREA, SEA ICE, ICE MECHANICS, GRAIN SIZE, ICE MODELS, ICE SHEETS, TESTS.

This report describes the growth characteristics and crystalline textures of urea ice sheets which are now used extensively in the CRREL test basin for modeling sea ice. The aims of the report are to describe the different kinds of crystalline texture encountered in urea ice sheets and to show that even small variations in texture can drastically influence the mechanical behavior of urea ice sheets. Standard petrographic techniques for studying microstructure in thin sections were used on 24 urea ice sheets. These investigations entailed observations of the crystalline texture of the ice (including details of the subgrain structure), grain size measurements, and studies of the nature and extent of urea entrapment and drainage patterns in the ice. Increased knowledge of the factors controlling the crystalline characteristics of urea ice sheets has progressed to the point where test basin researchers at CRREL are now able to fabricate ice sheets with prescribed structures leading to predictable mechanical properties.

CR 84-25

REVIEW OF ANTITANK OBSTACLES FOR WINTER USE.

Richmond, P.W., Sep. 1984, 12p., ADB-100 767L, 24 refs.
40-3306

TANKS (COMBAT VEHICLES), DETONATION WAVES, MILITARY OPERATION, SNOW COVER EFFECT, ICE COVER EFFECT, BOREHOLES, MODELS, DRILLING, AUGERS.

This report is a review of information, equipment and procedures related to the use of antitank obstacles in winter. Demolition and construction of expedient and existing obstacles are discussed. Obstacle performance models are identified and their methodology is discussed. Five tasks are identified as areas requiring further research: 1) investigation of the use of light-weight augers for drilling bore holes in frozen soil, 2) investigation of the effectiveness of Soviet-style snow obstacles, 3) development of a model of vehicle performance on snow-covered slopes, 4) development of a design procedure and performance model for step-type obstacles when snow covered, and 5) development of construction procedures for creating ice slopes.

CR 84-26

SHORE ICE RIDE-UP AND PILE-UP FEATURES. PART 2: ALASKA'S BEAUFORT SEA COAST—1983 AND 1984.

Kovacs, A., Sep. 1984, 28p. + map, ADA-148 428, 16 refs.
39-1142

ICE OVERRIDE, ICE PILEUP, SEA ICE DISTRIBUTION, ICE MECHANICS, FAST ICE, BEACHES, SHORES, BEAUFORT SEA, ARCTIC OCEAN.

Observations of shore ice pile-up and ride-up along the Alaska Beaufort Sea coast in 1983 and 1984 are presented. New information on historical accounts of onshore ice movement, uncovered since publication of Part 1 in this series, is reported. An account is given of ice overtopping a concrete caisson exploration island in the Canadian Beaufort Sea.

CR 84-27

RADAR INVESTIGATIONS ABOVE THE TRANS-ALASKA PIPELINE NEAR FAIRBANKS.

Arcone, S.A., et al, Oct. 1984, 15p., ADA-150 303, 15 refs.
Delaney, A.J.
39-2098

RADAR ECHOES, UNDERGROUND PIPELINES, REMOTE SENSING, FREEZE THAW CYCLES, WATER TABLE, WATER CONTENT, REFRACTION, UNITED STATES—ALASKA—FAIRBANKS.

Radar and wide-angle reflection and refraction (WARR) profiles were obtained across three buried sections of the trans-Alaska pipeline near Fairbanks in late April 1983. A broad-band, pulsed radar operating in the VHF (very high frequency) range was used. The surficial geology at the three sites consisted of gravel (dredge tailings), silt and alluvium, respectively, and the sites were marginally frozen or completely thawed. At the gravel site the pipe (approximately 2 m deep) and an underlying water table were easily visible. There was no radar signature of the pipe at the silt site: the WARR profiles verified the high absorption of the material. The response was marginal at the alluvium site. High absorption due to thawing or marginal freezing conditions about the pipe makes radar a generally poor choice for mapping freeze-thaw boundaries but a good choice for estimating material state and moisture content.

CR 84-28

POLYETHYLENE GLYCOL AS AN ICE CONTROL COATING.

Itagaki, K., Dec. 1984, 11p., ADA-150 466, 13 refs.

40-3577

PROTECTIVE COATINGS, ICE CONTROL, ICE PREVENTION, RESINS, MELTING POINTS, SNOW ACCUMULATION, ICE ACCRETION, COUNTERMEASURES, TESTS.

The properties of polyethylene glycol (PEG) as a sacrificial ice control coating are discussed. PEG is effective longer than many single component coatings, and it has low toxicity and a high flash point. The results of preliminary experiments on PEG's ability to control snow accumulation on a panel and ice accumulation on a cryogenic tank are also discussed.

CR 84-29

REVERSE PHASE HPLC METHOD FOR ANALYSIS OF TNT, RDX, HMX AND 2,4-DNT IN MUNITIONS WASTEWATER.

Jenkins, T.F., et al, Dec. 1984, 95p., ADA-155 983, Refs. p.36-38.

Bauer, C.F., Leggett, D.C., Grant, C.L.

40-3578

WATER POLLUTION, WASTE DISPOSAL, EXPLOSIVES, CHEMICAL ANALYSIS, DETECTION, TESTS, MILITARY FACILITIES, STATISTICAL ANALYSIS.

An analytical method was developed to determine the concentrations of HMX, RDX, TNT and 2,4-DNT in munitions wastewater. The method involves dilution of an aqueous sample with an equal volume of methanol-acetonitrile solvent mixture, filtration through a 0.4 micron polycarbonate membrane and analysis of a 100 microL subsample by Reverse-phase, high-performance liquid chromatography using an LC-8 column. Retention times of these four analytes, their degradation products, and impurities expected in wastewater matrices were determined for two eluent compositions. An eluent of 50% water, 38% methanol and 12% acetonitrile successfully separated HMX, RDX and TNT from each other and the potential interferents. The method provided linear calibration curves over a wide range of concentrations.

CR 84-30

IMPACT OF SLOW-RATE LAND TREATMENT ON GROUNDWATER QUALITY: TOXIC ORGANICS.

Parker, L.V., et al, Dec. 1984, 36p., ADA-153 253, Refs. p.19-21.

Jenkins, T.F., Foley, B.T.

40-3361

GROUND WATER, WASTE TREATMENT, WATER TREATMENT, LAND RECLAMATION, SEEPAGE, ORGANIC NUCLEI, ENVIRONMENTAL IMPACT.

The removal efficiency for 16 organic substances in wastewater was studied on an outdoor, prototype slow-infiltration system. The initial concentration of each of these substances in the wastewater was approximately 50 microgram/L. Removal was via volatilization during spray application and subsequent adsorption in the soil. The percent removal during spraying could be estimated from the liquid-phase transfer coefficient; losses were up to 70% for the most volatile components. The total percent removal for the system, based on the concentration in the percolate, was more than 98% for all substances. Only chloroform, which has a low octanol-water coefficient and according to the literature is not degradable aerobically, was continuously detected in the percolate. The major final removal mechanisms are believed to be volatilization and biodegradation-biotransformation. Breakthrough of several other organics in early spring as a result of application during the colder months was also observed. The two substances that were most persistent in the soil were PCBs and diethylphthalate. PCBs were apparently slowly lost from the system, probably by volatilization. The behavior of diethylphthalate was different in the two soils tested but was more recalcitrant than expected.

CR 84-31

DETECTION OF BURIED UTILITIES. REVIEW OF AVAILABLE METHODS AND A COMPARATIVE FIELD STUDY.

Bigl, S.R., et al, Dec. 1984, 36p., ADB-090 068L, 21 refs.

Henry, K.S., Arcone, S.A.

39-2918

UNDERGROUND FACILITIES, UTILITIES, DETECTION, FROST PENETRATION, MAGNETIC SURVEYS, GEOPHYSICAL SURVEYS, EARTHWORK.

Locating buried utilities is often necessary for repair, servicing, or prevention of damage when earthwork is to be conducted in a particular area. Of the many methods available for detection of buried utilities, those in most wide-spread use are magnetic induction, magnetometry, and radiofrequency tracking. Comparative field tests of 11 locators using these three operating methods were conducted in Hanover, New Hampshire, and eight of these were further tested at the U.S. Military Academy, West Point, New York, and the Stewart Army Subpost, Newburgh, New York. At West Point and Newburgh, the nine sites included a variety of utility types including iron and steel pipe, cable, vitreous tile and plastic, as well as different terrain and groundcover characteristics. Tests with the radiofrequency tracking locators were insufficient to evaluate their ability to locate nonmetallic pipe or to judge if one locator was superior to the other. Although not statistically different, slightly more accurate average readings were obtained with the magnetic induction and magnetometer instruments over cable than over pipe. Shallow utilities (<3.5 ft) were located slightly more accurately than deeper ones. In general, the low- to mid-priced magnetic induction locators appeared to be the most cost effective. Problems with accuracy in utility location occurred mainly at sites with steep topography or where utilities were in very close proximity. Successful operation of the instruments required only a small amount of training.

CR 84-32

SHORELINE EROSION PROCESSES: ORWELL LAKE, MINNESOTA.

Reid, J.R., Dec. 1984, 101p., ADA-152 952, Refs. p.54-56.

40-3545

SHORE EROSION, SLOPE PROCESSES, LAKE WATER, BANKS (WATERWAYS), GROUND THAWING, SEDIMENT TRANSPORT, WATER WAVES, RESERVOIRS, SHORELINE MODIFICATION, RAIN, SEASONAL VARIATIONS, METEOROLOGICAL FACTORS.

Orwell Lake, in west-central Minnesota, is a flood-control, water-management reservoir first impounded in 1953. Subsequent erosion of the shoreline and a lack of knowledge of slope erosion processes in this region prompted this study to identify and quantify the processes there. The processes were measured at selected sites between June 1980 and June 1983. Erosion of the banks is primarily caused by three processes: rain, frost thaw, and waves. The first two processes tend to move sediment to the base of the steep slopes, forming a relatively gentle surface of accumulation. Wave action then tends to move this sediment into the lake. Analysis of the data collected over three years has confirmed that wave action is the dominant erosion process, providing almost 77% of the erosion during the 1981-82 study year. During the 1981 high pool level, 2,089 Mg of sediment, mostly colluvium, was removed from the lower slopes by wave action striking the 1.62 km of eroding shoreline. More than 4,300 Mg was eroded by waves accompanying the higher pool levels of 1982.

CR 84-33

ICE FORCES ON RIGID, VERTICAL, CYLINDRICAL STRUCTURES.

Sodhi, D.S., et al, Dec. 1984, 36p., ADA-151 393, 32 refs.

Morris, C.E.

39-2515

ICE PRESSURE, ICE LOADS, OFFSHORE STRUCTURES, COLD WEATHER CONSTRUCTION, PILES, ICE BREAKING, ICE SOLID INTERFACE, ICE COVER THICKNESS, FLEXURAL STRENGTH, COMPRESSIVE PROPERTIES, VELOCITY, EXPERIMENTATION.

A small-scale experimental study was conducted to characterize the magnitude and nature of ice forces during continuous crushing of ice against a rigid, vertical, cylindrical structure. The diameter of the structure was varied from 50 to 500 mm, the relative velocity from 10 to 210 mm/s, and the ice thickness from 50 to 80 mm. The ice tended to fail repetitively, with the frequency of failure termed the characteristic frequency. The characteristic frequency varied lineraly with velocity and to a small extent with structure diameter. The size of the damage zone was 10 to 50% of the ice thickness, with an average value of 30%. The maximum and mean normalized ice forces were strongly dependent on the aspect ratio (structure diameter/ice thickness). The forces increased significantly with decreasing aspect ratio, but were constant for large aspect ratios. The maximum normalized forces appeared to be independent of strain role.

CR 85-01

PROTOTYPE DRILL FOR CORE SAMPLING FINE-GRAINED PERENNIALLY FROZEN GROUND.

Brockett, B.E., et al, Jan. 1985, 29p., ADA-152 388, 11 refs.

Lawson, D.E.

40-3579

DRILLS, AUGERS, PERMAFROST THERMAL PROPERTIES, FROZEN GROUND TEMPERATURE, CORING, SAMPLING, GROUND ICE, GRAIN SIZE, TEMPERATURE EFFECTS, COST ANALYSIS.

An inexpensive drill has been modified to provide researchers with the ability to auger an open hole or to acquire continuous, undisturbed 76-mm-diam core samples of a variety of perennially frozen materials that are suitable for chemical and petrographic analysis. It was developed by field testing in support of research from 1980 to 1983. Operation of the drill is based mainly on using a minimum of power to cut through frozen ground with tungsten carbide cutters on a CRREL coring auger. The ice content, temperature and grain size of the frozen sediments are important variables determining the sampling depth. Perennially frozen sediments with temperatures in the range of -0.5 C to -8.5 C have been continuously cored with this drill. Drilling and sampling are most efficiently conducted when ambient air temperatures are below freezing and the active layer is frozen. The self-contained lightweight drill is readily transportable off-road by helicopter or tracked vehicle, or by towing over roads. It is locally self-mobile by use of a winch. Total cost of the drill and modifications is estimated at approximately $10,000.

CR 85-02

EFFECT OF NONUNIFORM SIZE ON INTERNAL STRESSES IN A RAPID, SIMPLE SHEAR FLOW OF GRANULAR MATERIALS. PART 1. TWO GRAIN SIZES.

Shen, H.H., Feb. 1985, 18p., ADA-154 045, 18 refs.

40-38

SHEAR FLOW, PARTICLE SIZE DISTRIBUTION, MICROSTRUCTURE, MATERIALS, STRESSES, STRAINS, AVALANCHE MECHANICS, MATHEMATICAL MODELS.

Existing theories that predict the stress-strain rate relationship in a rapidly sheared granular flow can only treat materials that are made of single-size particles. However, granular flows usually involve materials of mixed sizes. It has been observed in many laboratory studies that size distribution has a significant effect on the flow of a granular material. Despite its importance, no quantitative theory has been devised that can explain the effect of size distribution. An analytical model is developed here to quantify the stresses in a mixture of spheres with two different sizes and identical material properties. Binary collisions between adjacent particles are considered as the dominating stress-generating mechanism. Comparisons between the theoretical results and the existing laboratory data show good agreement.

CR 85-03

EFFECT OF NONUNIFORM SIZE ON INTERNAL STRESSES IN A RAPID, SIMPLE SHEAR FLOW OF GRANULAR MATERIALS. PART 2. MULTIPLE GRAIN SIZES.

Shen, H.H., Feb. 1985, 20p., ADA-154 046, 19 refs.

40-439

SHEAR FLOW, PARTICLE SIZE DISTRIBUTION, MICROSTRUCTURE, STRESSES, MATERIALS, SHEAR STRESS.

In the past all theoretical analyses for rapdily sheared granular flows assumed that the granular solids are either disks or spheres and are uniform in size. However, natural materials that create these granular flows are in general irregular in shape and have various spectra of sizes. The stress and rate of energy dissipation levels in granular flows are significantly influenced by the size distribution. In part 1 of this report series (see 40-38, CR 85-2) the formulation of the constitutive equations considering a two-size granular mixture is presented, where the ratio of the two sizes is nearly one. Here, in part 2, the constitutive equations for a two-size mixture are extended to include a general size ratio. In addition, a complete spectrum of size distribution is incorporated, which allows the quantification of the size distribution effect in the most general way. In analyzing the stresses, intergranular collision is assumed to be the major dynamic activity at the microscopic level. Because of the present limited knowledge of treating shape effects, the analysis is confined to the flow of either disks or spheres. The result of this work provides necessary information for a more realistic analysis of natural and industrial granular flows.

CR 85-04

PROPULSION TESTS IN LEVEL ICE ON A MODEL OF A 140-FT WTGB ICEBREAKER.

Tatinclaux, J.C., Mar. 1985, 13p., ADA-154 075, 6 refs.

39-3956

ICEBREAKERS, ICE CONDITIONS, ICE STRENGTH, ICE BREAKING, ICE COVER THICKNESS, LAKE ICE, FLEXURAL STRENGTH, VELOCITY, TESTS, MODELS.

Results of propulsion tests in level ice on a model of the WTGB 140-ft Great Lakes icebreaker are presented and compared to available full-scale data. In spite of the difficulties in exactly modeling full-scale conditions, the predictions based on the model test results of the ship performance compared reasonably well to those measured during full-scale trials. Several possible sources of errors are identified. In particular, duplication at the model scale of the ship hull's ice friction coefficient is considered to be critical in determining the ice resistance and the corresponding propulsion characteristics, namely propeller speed, thrust and torque.

CR 85-05

NUMERICAL MODELING OF SEA ICE DYNAMICS AND ICE THICKNESS CHARACTERISTICS. A FINAL REPORT.

Hibler, W.D., III, Mar. 1985, 50p., ADA-154 600, Refs. p.35-38.

40-3362

ICE MECHANICS, DRIFT, SEA ICE, ICE COVER THICKNESS, ICE EDGE, MATHEMATICAL MODELS, HEAT BALANCE.

A dynamic-thermodynamic sea ice model is extended to include a full thermodynamic code and a complete multilevel ice thickness distribution. The variable thickness formulation includes a more realistic parameterization of ice ridging than used in previous models. Seasonal simulations have been performed using this model and the results have been analyzed with particular emphasis of the ridge buildup results off the Canadian Archipelago and off the North Slope. This report presents a complete description of this model and discusses progress made on examining and testing the variable thickness extensions.

CR 85-06

KINETIC FRICTION COEFFICIENT OF ICE.

Forland, K.A., et al, Mar. 1985, 40p., ADA-155 035, 23 refs.

Tatinclaux, J.C.

39-3957

ICE SOLID INTERFACE, ICE FRICTION, ICE HARDNESS, SURFACE ROUGHNESS, ENGINEERING, VELOCITY, TESTS.

This study investigates the relative influence of various parameters on the kinetic friction coefficient between ice and different surfaces. Friction tests were performed with urea-doped, columnar ice, studying the parameters of normal pressure, velocity, type of material roughness, ice orientation, ice hardness and test configuration. Tests were conducted by pulling a sample of ice over a sheet of material and by pulling a sample of material over an ice sheet. An ambient temperature of -1.5 was maintained throughout, and the ice surface hardness was measured using a specially designed apparatus. The results of the friction tests revealed that the behavior of kinetic friction coefficient with varying velocity was significantly influenced by the test configuration and material roughness. The magnitude of the kinetic friction coefficient was also affected by varying normal pressure, surface roughness and ice hardness. Additional guidelines for standardized ice friction tests and future investigations are recommended.

CR 85-07

MEASURING THERMAL PERFORMANCE OF BUILDING ENVELOPES: NINE CASE STUDIES.

Flanders, S.N., Mar. 1985, 36p., ADA-155 083, 13 refs.

39-3958

THERMAL INSULATION, BUILDINGS, HEAT FLUX, THERMAL MEASUREMENTS, THERMOCOUPLES, COMPUTER APPLICATIONS, COST ANALYSIS, WIND FACTORS.

Nine buildings at Ft. Devens were the object of a study employing heat flux sensors, thermocouples, a computer-controlled data acquisition system and infrared thermography. The purpose was to measure the R-values of those buildings to determine their economic potential for improved insulation. The sample included four frame buildings, two masonry buildings, and three frame buildings with brick facing. The technique for measuring R-values proved repeatable and accurate within 15%. Sampling a small representative sample sufficiently characterizes the entire stock of buildings. Measurement is more important for poorly insulated buildings, since the beginning R-value has a drastic impact on the budget for a cost-effective reinsulation project. At Ft. Devens, installing an external Styrofoam insulation system on concrete block barracks has a savings-to-investment ratio of about 1.4

CR 85-08

ICE FOG AS AN ELECTRO-OPTICAL OBSCURANT.

Koh, G., Mar. 1985, 11p., ADA-155 059, 22 refs.

39-3959

ICE FOG, INFRARED RADIATION, LIGHT (VISIBLE RADIATION), RADIATION ABSORPTION, SCATTERING, ELECTROMAGNETIC PROPERTIES, ICE CRYSTAL OPTICS, ANALYSIS (MATHEMATICS).

The extinction of visible light and infrared radiation (at wavelengths of 3.5 and 10.6 micron) by ice fog is considered utilizing theoretical concepts and historical experimental data. The reliability of the spherical approximation of ice fog for Mie calculations is examined and judged adequate for forward scatter situations but limited for side and backscatter applications. The relative efficacy in penetrating ice fog as a function of size distribution is evaluated for the wavelengths considered.

CR 85-09

THERMAL CONVECTION IN SNOW.

Powers, D.J., et al, May 1985, 61p., ADA-157 577, Refs. p.46-48.

Colbeck, S.C., O'Neill, K.

40-1009

SNOW THERMAL PROPERTIES, SNOW HEAT FLUX, HEAT TRANSFER, WATER VAPOR, TEMPERATURE GRADIENTS, POROUS MATERIALS, THERMAL CONDUCTIVITY, CONVECTION, MATHEMATICAL MODELS, LATENT HEAT, EXPERIMENTATION, METAMORPHISM (SNOW).

Large temperature gradients applied to a snow cover drive water vapor upwards and result in rapid recrystallization of snow crystals. The same temperature gradients create gradients of air density that can cause flows of air through the snow cover. The formalism necessary to describe these flows is developed here in an effort to include the convenction of vapor in the understanding of snow metamorphism. The theory of convection through porous media is extended to include the transport of water vapor, which is important because of its latent heat. Results are presented in terms of a Lewis number, defined as the ratio of thermal to mass diffusivities. For Lewis numbers greater than 1.0, phase change intensifies convection, and for Lewis numbers less than 1.0, phase change retards convection. Two boundary conditions of special interest in the study of snow, a constant heat flux bottom and a permeable top, are investigated.

CR 85-10

REVIEW OF METHODS FOR GENERATING SYNTHETIC SEISMOGRAMS.

Peck, L., June 1985, 39p., ADA-159 128, Refs. p.36-39.

40-1587

SOIL MECHANICS, SEISMOLOGY, GEOPHYSICAL SURVEYS, WAVE PROPAGATION, COMPUTER APPLICATIONS, ANALYSIS (MATHEMATICS).

Various methods of generating synthetic seismograms are reviewed and examples of recent applications of the methods are cited. Body waves, surface waves, and normal modes are considered. The analytical methods reviewed include geometric ray theory, generalized ray theory (Cagniard-de Hoop method), asymptotic ray theory, reflectivity method, full wave theory, and hybrid methods combining ray theory and mode theory. Two numerical methods, those of finite differences and finite elements, and a hybrid method combining finite differences with asymptotic ray theory are described. Limitations on the application or validity of the various methods are stated.

CR 85-11

RECONNAISSANCE OBSERVATIONS OF LONG-TERM NATURAL VEGETATION RECOVERY IN THE CAPE THOMPSON REGION, ALASKA, AND ADDITIONS TO THE CHECKLIST OF FLORA.

Everett, K.R., et al, June 1985, 75p., ADA-158 724, Refs. p.44-48.

Murray, B.M., Murray, D.F., Johnson, A.W., Linkins, A.E., Webber, P.J.

40-440

REVEGETATION, TUNDRA, PERMAFROST, SOIL EROSION, ENVIRONMENTAL PROTECTION, ACTIVE LAYER, VEGETATION, FROST ACTION, CLASSIFICATIONS, LANDFORMS, ENVIRONMENTAL IMPACT.

The diversity of disturbance types, landforms, vegetation and soils, together with the large, well-documented flora, makes Cape Thompson an ideal site to study long-term (20-year) environmental adjustments after impact. Man-caused disturbances there between 1958 and 1962 fall into three categories: runways, excavations and off-road vehicle trails. In addition, natural disturbance by frost action creates scars. Reestablished vegetation after 20 years consisted of species found in adjacent undisturbed landscapes.

CR 85-12

ANALYSIS OF RIVER WAVE TYPES.

Ferrick, M.G., June 1985, 17p., ADA-158 683, For another source see 39-3098. 20 refs.

40-1050

WATER WAVES, RIVER FLOW, RIVER ICE, DAMS, UNSTEADY FLOW, ICE JAMS, RUNOFF, FRICTION, MATHEMATICAL MODELS.

In this paper, we consider long-period, shallow-water river waves that are a consequence of unsteady flow. River waves result from hydroelectric power generation or flow control at a dam, the breach of a dam, the formation or release of an ice jam, and rainfall/runoff processes. The Saint-Venant equations are generally used to describe river waves. Dynamic, gravity, diffusion, and kinematic river waves have been defined, each corresponding to different forms of the momentum equation and each applying to some subset of the overall range of river hydraulic properties and time scales of wave motion. However, the parameter ranges corresponding to each wave description are not well defined, and the transitions between wave types have not been explored. This paper is an investigation into these areas, which are fundamental to river wave modeling. The analysis is based on the concept that river wave behavior is determined by the balance between friction and inertia.

CR 85-13

ELECTROMAGNETIC MEASUREMENTS OF MULTI-YEAR SEA ICE USING IMPULSE RADAR.

Kovacs, A., et al, Sep. 1985, 26p., ADA-160 737, 11 refs.

Morey, R.M.

40-1544

SEA ICE, ELECTROMAGNETIC PROPERTIES, ICE BOTTOM SURFACE, MARINE GEOLOGY, GEOPHYSICAL SURVEYS, ELECTRICAL RESISTIVITY, BRINES, DIELECTRIC PROPERTIES.

Sounding of multi-year sea ice, using impulse radar operating in the 80- to 500-MHz frequency band, has revealed that the bottom of this ice cannot always be detected. This paper discusses a field program aimed at finding out why this is so, and at determining the electromagnetic (EM) properties of multi-year sea ice. It was found that the bottom of the ice could not be detected when the ice structure had a high brine content. Because of brine's high conductivity, brine volume dominates the loss mechanism in first-year sea ice, and the same was found true for multi-year ice. A two-phase dielectric mixing formula, used by the authors to describe the EM properties of first-year sea ice, was modified to include the effects of the gas pockets found in the multi-year sea ice.

CR 85-14

VEGETATION AND ENVIRONMENTAL GRADIENTS OF THE PRUDHOE BAY REGION, ALASKA.

Walker, D.A., Sep. 1985, 239p., ADA-162 022, Refs. p.122-135.

40-1790

TUNDRA, VEGETATION, TEMPERATURE GRADIENTS, PLANTS (BOTANY), COASTAL TOPOGRAPHIC FEATURES, ICE WEDGES, SNOW DEPTH, TEMPERATURE EFFECTS, LOESS, HUMMOCKS, SOIL WATER, UNITED STATES—ALASKA.

The Prudhoe Bay region is a particularly interesting area of tundra because of its well-defined and steep environmental gradients, the combination of which has not been described elsewhere in the Arctic. It is a region of wet coastal tundra that has a unique substrate pH gradient, due in part to its coastal location. The prevailing northeast winds distribute loess from the Sagavanirktok River over most of the region. Areas downwind from the river have alkaline tundra with a gradient of declining soil pH values away from the river: the northwest portion of the region is not downwind from the river and consequently has acidic tundra. The coastal temperature gradient is among the steepest in the Arctic. Three of Young's (1971) four floristic zones, which are based on the amount of total summer warmth, are present within the region. The effects of the temperature gradient can be seen in the increase of the total number of plants in the flora and the increased plant productivity, particularly of shrubs, as one moves inland. The predominantly wet landscape also creates steep vegetation gradients within elevation changes of a few centimeters. Small hummocks and higher microsites associated with ice wedge polygon relief may be elevated only 10-25 cm above the level of saturated soils but can support rich mesic tundra plant communities.

CR 85-15

TNT, RDX AND HMX EXPLOSIVES IN SOILS AND SEDIMENTS. ANALYSIS TECHNIQUES AND DRYING LOSSES.

Cragin, J.H., et al, Oct. 1985, 11p., 13 refs.

Leggett, D.C., Foley, B.T., Schumacher, P.W.

40-3363

EXPLOSIVES, FREEZE DRYING, SOIL POLLUTION, SEDIMENTS, CHEMICAL ANALYSIS, COUNTERMEASURES, DRYING, ADSORPTION, ABSORPTION, TESTS.

A method for the analysis of TNT, RDX and HMX explosives in soils and sediments has been devloped. It consists of methanol extraction followed by reversed-phase high performance liquid chromatography using 10% acetonitrile/40% methanol/50% water as the eluant. This method was used to study the effect of various drying techniques upon the recovery of TNT, RDX and HMX from soil and sediment samples contaminated with high (%) and low (microgram/g) levels of these explosives. For highly contaminated samples, complete recovery of TNT and RDX was obtained using freeze drying while air drying at room temperature resulted in greater than 90% recovery for both explosives. Other techniques, such as oven drying at 105C, oven drying at 45C, microwave oven drying, and drying under infrared lamps, all resulted in greater losses, with TNT and RDX recoveries ranging from 76 to 90%. Drying losses were not due to simple volatilization but rather to chemical reaction and/or sorption. For soil and sediment samples containing low levels of TNT, RDX and HMX, recoveries of all three explosives were quantitative for all of the above drying techniques.

CR 85-16

MECHANICAL PROPERTIES OF MULTI-YEAR SEA ICE. PHASE 2: TEST RESULTS.

Cox, G.F.N., et al, Oct. 1985, 81p., ADA-166 333, 10 refs.

Richter-Menge, J.A., Weeks, W.F., Bosworth, H., Perron, N., Mellor, M., Durrell, G.

40-3364

ICE MECHANICS, ICE STRENGTH, SEA ICE, STRAINS, COMPRESSIVE PROPERTIES, ICE PHYSICS, PRESSURE RIDGES, TENSILE PROPERTIES, LOADS (FORCES).

This report presents the results of the second phase of a test program designed to obtain a comprehensive understanding of the mechanical properties of multi-year sea ice from the Alaskan Beaufort Sea. In Phase II, 62 constant-strain-rate uniaxial compression tests were performed on horizontal and vertical ice samples from multi-year pressure ridges to examine the effect of sample orientation on ice strength. Also conducted were 36 constant-strain-rate tension tests, 55 conventional triaxial tests and 35 constant-load compression tests on multi-year pressure ridge samples to provide data for developing ice yield criteria and constitutive laws. Data are presented on the strength, failure strain and modulus of multi-year sea ice under different loading conditions. The effects of ice temperature, porosity, structure, strain rate, confining pressure and sample orientation on the mechanical properties of multi-year sea ice are examined.

CR 85-17
FIELD TESTS OF THE KINETIC FRICTION COEFFICIENT OF SEA ICE.
Tatinclaux, J.C., et al, Oct. 1985, 20p., ADA-163 170, 4 refs.
Murdey, D.
40-3365
ICE FRICTION, SEA ICE, SURFACE PROPERTIES, STEEL STRUCTURES, SHIPS, ICE CRYSTAL STRUCTURE, PRESSURE, ICE STRENGTH, VELOCITY, TESTS.

This report presents the results of tests of the ice friction coefficient carried out during the May 1984 expedition of the *F.S. Polarstern off the coast of* Labrador. The test surfaces were Inerta-160-coated steel plates and bare steel plates, hand roughened and sandblasted. The main findings of the studies were: 1) columnar and granular sea ice showed no significant differences in friction coefficient; 2) for columnar ice, friction coefficient was independent of ice crystal orientation with respect to test surface; 3) friction coefficient was independent of normal pressure applied on ice sample; 4) friction coefficient initially decreased with increasing relative velocity between the ice sample and the test surface and reached a steady value at higher speeds; 5) friction coefficient increased with increasing surface roughness; 6) a wetting surface exhibited a higher friction coefficient than a nonwetting surface of the same or even higher roughness average.

CR 85-18
SORPTION OF MILITARY EXPLOSIVE CONTAMINANTS ON BENTONITE DRILLING MUDS.
Leggett, D.C., Nov. 1985, 33p., ADA-163 231, Refs. p.14-16.
40-3366
EXPLOSIVES, DRILLING FLUIDS, MILITARY OPERATION, POLLUTION, MUD, CHEMICAL COMPOSITION, ENVIRONMENTAL PROTECTION, ADSORPTION, ABSORPTION, ANALYSIS (MATHEMATICS).

Concern over the environmental fate of explosives has brought about development of sensitive analytical methods for measuring them in groundwater. In turn this concern has been extended to validating the sampling procedures for groundwater. This report addresses the potential effects of residual drilling muds on the analysis for explosive contaminants (TNT, DNT, RDX and HMX) in monitoring wells. The approach was to determine sorption isotherms for each contaminant. Sorption appeared to be independent of solids concentration. Linear isotherms were obtained for RDX and HMX over a range of analytic concentrations; therefore, a single constant can be used to estimate the amount sorbed when the solution concentration is known. Isotherms for TNT and DNT were not linear, however. Scatchard analysis suggested that the isotherms for these analytes could be resolved into two predominant components: a linear component above a certain sorbed quantity and a Langmuir-type component below this quantity. The experimental data were fitted by regression analysis using the appropriate model. The equations developed can be used to predict the sorbed fraction (analytical bias) for any combination of solids and analyte concentration. The amounts of bentonite found in some existing wells do not appear to be sufficient to cause significant bias in analyses for these explosive contaminants.

CR 85-20
CONSTITUTIVE RELATIONS FOR A PLANAR, SIMPLE SHEAR FLOW OF ROUGH DISKS.
Shen, H.H., et al, Dec. 1985, 17p., ADA-163 147, 10 refs.
Hopkins, M.A.
40-3367
SHEAR FLOW, SURFACE ROUGHNESS, FLOW RATE, FRICTION, STRESSES, AVALANCHES, COMPUTER APPLICATIONS, TESTS.

Stresses developed in a rapid, simple shear flow of disks are quantified. Collisional momentum transfer is considered to be the dominant stress generating mechanism. The disks are inelastic and frictional. The restitution coefficient and the coefficient of friction together determine the transfer of momentum and dissipation of energy during a collision. The frictional coefficient generates and maintains a rotational motion of disks. The total fluctuation motion of disks consists of two translational modes and one rotational mode. The rotational mode is found to depend on both the restitution and friction coefficient. Equipartitions of energy among all modes of motion is absent. The mean rotation, however, depends only on the mean flow gradient. The analysis assumes a constant magnitude for all fluctuation modes. Comparison with a computer simulated disk flow shows good agreement. This implies that the distribution of velocity magnitude may not be crucial to the quantification of stresses.

CR 85-21
ICE-CORING AUGERS FOR SHALLOW DEPTH SAMPLING.
Rand, J.H., et al, Dec. 1985, 22p., ADA-166 630, 12 refs.
Mellor, M.
40-3273
AUGERS, ICE CORING DRILLS, PERMAFROST, FROZEN GROUND, ICE SAMPLING, DRILLING, EQUIPMENT.

The development of lightweight coring augers for ice is reviewed. Emphasis is on equipment designed by the Cold Regions Research and Engineering Laboratory and its predecessor organizations for sampling to depths less than 20 m or so. Design and operation of the ACFEL/SIPRE/CRREL 3-in.-ID corer is discussed, and modifications of the basic design for powered operation and for drilling *in frozen soil are outlined.* Recent *replacements for the* traditional coring auger are described, and details are given for the construction and operation of the new 4 1/4-in-*ID* coring equipment. A powered *12-in.-ID drill for* shallow-depth coring is also described.

CR 85-22
LEVEL ICE BREAKING BY A SIMPLE WEDGE.
Tatinclaux, J.C., Dec. 1985, 46p., ADA-166 629, 6 refs.
40-3274
ICE BREAKING, ICEBREAKERS, ICE FLOES, ICE FRICTION, ICE LOADS, LOADS (FORCES), ICE MODELS, ICE PHYSICS, TESTS.

Tests in level ice on an idealized icebreaker bow in the shape of a simple wedge were conducted in the test basin. The horizontal and vertical forces on the wedge were measured, and floe size distribution in the wake of the wedge was observed. From the force measurements, the ice wedge/hull friction factor was calculated and in general agreement with the friction factor measured in separate friction tests. The ice floe length and ice floe area measured in the current study followed log-normal probability distributions defined by the length average and area average and corresponding standard deviations S(L) and S(A).

CR 86-03
EXPERIMENTAL DETERMINATION OF HEAT TRANSFER COEFFICIENTS IN WATER FLOWING OVER A HORIZONTAL ICE SHEET.
Lunardini, V.J., et al, June 1986, 81p., ADA-170 427, 32 refs.
Zisson, J.R., Yen, Y.-C.
40-4709
HEAT TRANSFER, WATER TEMPERATURE, WATER FLOW, ICE COVER EFFECT, ICE MELTING, ICE SURFACE, TESTS, VELOCITY, COMPUTER APPLICATIONS, TURBULENT FLOW.

Experiments to study the melting of a horizontal ice sheet with a flow of water above it were conducted in a 35-m-long refrigerated flume, with a cross section of 1.2x1.2 m. Water depth, temperature, and velocity were varied as well as the temperature and initial surface profile of the ice sheet. The heat transfer regimes were found to consist of forced turbulent flow at high Reynolds numbers with a transition to free convection heat transfer. There was no convincing evidence of a forced laminar regime. The data were correlated for each of the regimes, with the Reynolds number, Re, or the Grashof number combined with the Reynolds number.

SPECIAL REPORTS

SR 76-01

CLIMATIC AND SOIL TEMPERATURE OBSERVATIONS AT ATKASOOK ON THE MEADE RIVER, ALASKA, SUMMER 1975.

Haugen, R.K., et al, May 1976, 25p., ADA-025 193, 11 refs.

Brown, J., May, T.A.

32-1197

CLIMATOLOGY, AIR TEMPERATURE, SOIL TEMPERATURE, UNITED STATES—ALASKA—ATKASOOK.

Air temperatures measured during the summer of 1975 indicated that the Meade River site, 120 km south of Barrow, has a distinctly continental summer temperature pattern in comparison to Barrow, which is cooler and has a smaller daily temperature fluctuation. Stepwise multiple regression analysis indicated a significant relationship between current and previous day's air temperature and all of the (near) surface temperatures examined. Precipitation and pan evaporation were not significantly related to terrain surface temperatures. At the wet site, the warmest subsurface temperatures were measured in a shallow pond. Dry site temperatures were warmer and showed less variation with depth in comparison to wet site temperatures.

SR 76-02

REGIONALIZED FEASIBILITY STUDY OF COLD WEATHER EARTHWORK.

Roberts, W.S., July 1976, 190p., ADA-029 936, M.S. thesis. 91 refs.

32-1238

COLD WEATHER OPERATION, EARTHWORK, SOIL STRUCTURE, MAPPING, ECONOMIC ANALYSIS.

A regional approach is used to delineate areas in Canada and the United States, in which selected earthwork operations should receive careful consideration for winter execution. Soil texture and soil "form" or physical site environment are deemed important physical factors in the economic feasibility of cold weather earthwork. Summary maps showing significant soil forms and related feasible earthwork operations are presented. A general discussion of the importance of the soil form in the economic feasibility of winter earthwork is included. A summary is presented which shows, with respect to physiographic sections, the salient information and conclusions developed by this study. At least 94% of physiographic sections have two or more winter earthwork operations that are deemed feasible. Only 5 of 213 sections considered do not have any earthwork operations that appear feasible in the winter season.

SR 76-03

THERMOINSULATING MEDIA WITHIN EMBANKMENTS ON PERENNIALLY FROZEN SOIL.

Berg, R.L., May 1976, 161p., ADA-062 447, Ph.D. thesis. 120 refs.

32-1239

EMBANKMENTS, THERMAL INSULATION, PERMAFROST PRESERVATION, PROTECTIVE COATINGS, SOIL STABILIZATION, MATHEMATICAL MODELS.

Most transportation facilities proposed for arctic and subarctic regions will be constructed on embankments. Incorporation of a thermoinsulating layer within the embankment may permit use of reduced quantities of embankment material. Thermal design and analysis procedures applicable to embankments are reviewed and a two-dimensional numerical method coupling heat and mass transfer and vertical displacement is proposed. The modified Berggrer equation, a method developed by Lachenbruch, and a finite difference technique are used to illustrate design and analysis methods for insulated embankments on permafrost. Most applications of insulation have been in seasonal frost areas but a few test sections have been constructed on permafrost. Stability of thermal and physical properties is a desirable characteristic of thermoinsulating layers. Moisture absorption causes increased thermal conductivity and degradation of strength of some insulating materials. Several types of moisture barriers have been used but the most successful have been polyethylene sheets.

SR 76-04

CREEP THEORY FOR A FLOATING ICE SHEET.

Nevel, D.E., June 1976, 98p., ADA-026 122, 73 refs.

32-1240

FLOATING ICE, ICE CREEP, LOADS (FORCES), STRESSES, ICE MECHANICS, MATHEMATICAL MODELS.

The problem investigated is the prediction of the deflection and stresses in a floating ice sheet under loads which act over a long period of time. A review of analytical methods for predicting the bearing capacity of an ice sheet is given. The problem is formulated by assuming the ice is isotropic with a constant Poisson's ratio. The shear modulus is assumed to obey a linear viscoelastic model. The specific model selected is a series of one Maxwell model and two Voigt models. One of the Voigt models has a negative spring constant which produces tertiary creep. The ice model exhibits a primary, secondary, and tertiary creep response, similar to that observed in uniaxial creep tests of ice. The material properties in the viscoelastic model may be a function of the vertical position in the ice sheet, but all these material properties must be proportional to the same function of position. Using the thin-plate theory for the floating ice sheet, the solution is obtained for the deflection and stresses in the ice sheet for primary, secondary, and tertiary creep regions. It is then shown that for a load that is not distributed over a large area, the time-dependent part of the deflection and stresses is relatively independent of the load's distribution. For the elastic case, the stress significantly depends upon the load's distribution. Results are given for the deflection and stresses as a function of time and distance from the load. The maximum deflection and stresses occur at the center fo the load. At this point the deflection increases with time, while the stresses decrease.

SR 76-05

UTILITY DISTRIBUTION SYSTEMS IN ICELAND.

Aamot, H.W.C., May 1976, 63p., ADA-026 956.

32-1241

UTILITIES, WASTE DISPOSAL, SEWAGE DISPOSAL, SUBARCTIC LANDSCAPES, ICELAND.

The study reports on new developments and special problems or solutions in water distribution systems, sewage collection systems, heat distribution and electric transmission system. Cold weather considerations are highlighted. For water and sewage transport, the use of ductile iron, concrete and plastic materials is reported. Utility lines are generally placed individually, utilidors are too expensive for most installations except in some city center locations. Heat distribution with hot water from geothermal wells is mostly one-way piping. After heating, the water is discharged through the sewage system. Street heating is being expanded. With electric distribution, the use of self-supporting aerial cables is becoming popular because it is very cost-effective and reliable. Within the city, all distribution is under ground. Arcing of isolators on high voltage transmission lines due to salt from the ocean atmosphere is being reduced with silicone fluids.

SR 76-06

INFLUENCE OF INSULATION UPON FROST PENETRATION BENEATH PAVEMENTS.

Eaton, R.A., et al, May 1976, 41p., ADA-026 957, 10 refs.

Dukeshire, D.E.

32-1242

PAVEMENTS, SUBGRADE PREPARATION, FROST HEAVE, FROST PENETRATION, CELLULAR MATERIALS, THERMAL INSULATION.

In order to minimize differential frost heaving caused by variable in-situ soil conditions, granular material is placed on top of the frost-susceptible subgrade. This creates a uniform layer to bridge subsurface irregularities in soil properties. This method of protecting the pavement structure can be costly. A method of reducing the amount of granular material is the use of a thermal insulating layer beneath all or part of the base course which prevents freezing temperatures from reaching the non-uniform subgrade. A test road which includes styrofoam board insulated test sections was constructed at CRREL in 1973. A transition section was built between a control section and an insulated section to minimize the drastic difference in frost penetration and resultant differential frost heave. Large temperature differences were measured between the insulated and conventional sections, frost penetrations were one-third as deep beneath the insulated section, differences in frost heave were negligible, and pavement deflections were approximately the same on the two sections. Surface differential icing did occur between the control and insulated sections.

SR 76-07

SKYLAB IMAGERY: APPLICATION TO RESERVOIR MANAGEMENT IN NEW ENGLAND.

McKim, H.L., et al, Sep. 1976, 51p., ADA-030 329, 24 refs.

Gatto, L.W., Merry, C.J., Haugen, R.K.

32-1243

AERIAL SURVEYS, SPACEBORNE PHOTOGRAPHY, MAPPING, RESERVOIRS.

The purpose of this investigation was to determine the utility of Skylab S190A and B photography for providing reservoir management information in New England. LANDSAT, Skylab S190A and S190B and RB-57/RC8 images were reduced to a common scale of 1:63,360 for a mapping base to demonstrate the extent to which the imagery could be utilized in the preparation of reconnaissance land use maps. Visual interpretations were accomplished on original NASA color infrared S190A/B and RB-57/RC8 transparencies and a LANDSAT false color print made in-house. Ancillary data were not used during the mapping exercise to eliminate bias in the comparisons and to ensure that the results were derived strictly from interpretations of tones and textures on the photography. The classification scheme was a modified version of the U.S. Geological Survey Land Use Classification System for use with remote sensor data. The relative utility of the multiband imagery in identifying and quantifying hydrologic factors was evaluated. The land use statistics for two small watersheds were determined and the effects of these land use factors were appraised for possible contribution to runoff potential. This appraisal indicated that basin topography and the nature of runoff may be more important factors in predicting volume of runoff from a watershed than land use factors. Comparisons of the usefulness of the various imagery systems are made.

SR 76-08

SURVEY OF ROAD CONSTRUCTION AND MAINTENANCE PROBLEMS IN CENTRAL ALASKA.

Clark, E.F., et al, Oct. 1976, 36p., ADA-032 085, 21 refs.

Simoni, O.W.

32-1244

ROADS, WINTER MAINTENANCE, ROAD ICING, PERMAFROST PRESERVATION, THERMAL INSULATION, EROSION.

A survey of road construction and maintenance problems in central Alaska is presented. The problems of poor fill and foundation material, permafrost degradation under pavement and shoulders, slope instability, water erosion, road icing from subsurface seepage and culvert icing are described. Possible solutions to road maintenance problems in central Alaska include the use of insulating materials in permafrost areas, MESL construction when non-frost-susceptible soils are unavailable, and the use of improved drainage in areas where extensive icing occurs. Bridge damage, erosion of sidehill cuts and embankment instability are also discussed and potential solutions are given.

SR 76-09

COMPRESSED AIR SEEDING OF SUPERCOOLED FOG.

Hicks, J.R., Oct. 1976, 9p., ADA-040 819, 1 ref.

32-1245

SUPERCOOLED FOG, CLOUD SEEDING, FOG DISPERSAL, ICE CRYSTAL FORMATION.

Two series of experiments, 25 in a light fog and 25 in a heavy fog, were conducted in the CRREL cold cloud chamber. Compressed air was used to glaciate the -4C fog. The gage air pressure was 413.7 kPa. These tests showed that the number of ice crystals produced exceeded the number of water droplets in the fog by a factor of 21 for a light fog and 133 for a heavy fog. Approximately 2.6 times as many ice crystals were created in a heavy fog than were created in a light fog.

SR 76-10

TEMPORARY ENVIRONMENT. COLD REGIONS HABITABILITY.

Bechtel, R.B., et al, Oct. 1976, 162p., ADA-032 353, Bibliography p.115-116.

Ledbetter, C.B.

32-1246

ENVIRONMENTS, HUMAN FACTORS ENGINEERING, BUILDINGS.

After classifying government environments in Alaska and studying four Federal Aviation Administration (FAA) and three Aircraft Control and Warning (AC&W) stations (in Phases 1 and 2), a cold regions environmental psychology behavior setting survey was made of Fort Wainwright, Alaska, to complete Phase 3. Phase 4 analyzed Fort Wainwright data and compared it with the FAA and AC&W data and previous studies. The military locations could be characterized as temporary environments. The military environments differed from civilian environments in the behavioral areas of religion, government and professionalism. FAA stations were found to have the richest environment and AC&W stations the most deprived. Yet AC&W stations compensated by providing greater leadership opportunities. Small installations had an advantage over large installations in the participation level of their populations in recreational and other activities. Family housing, transient housing, barracks and work environments of Fort Wainwright were studied. Habitability guidelines were suggested for minimal renovation, major renovation and new construction of these kinds of buildings. An overall plan for a more habitable location of post facilities was suggested. The behavior setting survey technique in shortened form proved useful in this study. Suggestions for future research in testing habitability guidelines were made.

SR 76-11

OBSERVATIONS ALONG THE PIPELINE HAUL ROAD BETWEEN LIVENGOOD AND THE YUKON RIVER.

Berg, R.L., et al, Oct. 1976, 73p., ADA-033 380, 7 refs.
Smith, N.
32-1247
ROADS, SLOPE STABILITY, GROUND ICE, VEGETATION.

Periodic observations over a six-year period along the TAPS Road have been evaluated with respect to construction and slope stabilization techniques in ice-rich roadway cuts and embankment subgrades. Lateral drainage ditches of sufficient width to handle construction excavation equipment, along with near-vertical slope cuts with hand-cleared tops equal in width to one and one-half times the height of the cuts, significantly enhance natural processes of slope stabilization. Right-of-way clearing limited to the toe of embankment fill slopes minimizes subsidence of the roadway and its shoulder slopes. In extremely ice-rich soil cuts, the seeding of the slopes should not be attempted until late in the first thaw season for best results. Natural woody growth can be expected to have a substantial stabilizing effect after five or six thaw seasons but could be accomplished sooner by planting tree seedlings. Attempts to stabilize ice-rich cut slopes with applications of insulation are not very effective and seem to prolong the natural stabilization process.

SR 76-12

OPERATIONAL REPORT: 1976 USACRREL-USGS SUBSEA PERMAFROST PROGRAM BEAUFORT SEA, ALASKA.

Sellmann, P.V., et al, Oct. 1976, 20p., ADA-032 440, 5 refs.
Lewellen, R.I., Ueda, H.T., Chamberlain, E.J., Blouin, S.E.
32-1248
OFFSHORE DRILLING, LOGISTICS, SEA ICE, SUBSEA PERMAFROST.

During the spring of 1976, three holes were drilled offshore in the Prudhoe Bay area using the sea ice cover as a drilling platform. The objectives of this program were to obtain samples and subsurface information to aid in quantification of the engineering characteristics of permafrost beneath the Beaufort Sea as well as to conduct supporting thermal and geological studies. The results of the drilling and related investigations are being used in conjunction with data from other subsea permafrost projects to develop maps and models for the prediction of permafrost occurrence in this offshore environment. The project also provides a means of testing drilling, sampling, and in-situ measurement techniques in an offshore setting where material types and sea ice conditions make acquisition of undisturbed samples extremely difficult. This report documents the operational aspects of the spring 1976 field study; subsequent reports will cover the technical and research results.

SR 76-13

ENVIRONMENTAL ANALYSES IN THE KOOTENAI RIVER REGION, MONTANA.

McKim, H.L., et al, Nov. 1976, 53p., ADA-033 500, 11 refs.
Gatto, L.W., Merry, C.J., Brockett, B.E., Bilello, M.A., Hobbie, J.E., Brown, J.
32-1255
CLIMATOLOGY, RESERVOIRS, ICE COVER, LIMNOLOGY, SPACEBORNE PHOTOGRAPHY, UNITED STATES—MONTANA—KOOTENAI RIVER.

The purpose of this investigation was: 1) to compile and analyze climatic data for the past 10 years from all available weather observing stations in the East Kootenai River Basin, 2) to analyze changes in ice and snow cover, and turbidity and plankton blooms on Lake Koocanusa, 3) to assess the present limnology of Lake Koocanusa and the potential for water quality problems, especially eutrophication, and 4) to demonstrate the reliability of the LANDSAT Data Collection Platform (DCP)-Martek Water Quality Monitor system for acquisition of data from a remote site. Results of the investigations indicate that the Kootenai region is about twice as cold as the Libby region in winter, and that reservoir ice first forms along the shore in the northern region in late November and in the southern part in mid-December, with total freeze-over usually occurring 2 to 4 weeks later. Ice break-up in the northern sections usually occurs 1-3 weeks later than in southern areas; average annual snowfall is 42 to 144 in., with ice thickness and snowfall varying with relief. Variations in areal distribution of snow within the basin and ice cover on the reservoir were observable for periods from January to October 1973, and reservoir turbidity was observed to increase south of Ellsworth and Stenerson Mountains. Low algal productivity observed was due to the algae being circulated most of the time below the depth of 1% light and due to high turbidity. The DCP-Martek system operated well and reliable data were received while the system was located in the pool above Libby Dam and downstream below the dam. Brief interruptions in data transmissions occurred in April, when the Martek sensor showed a few minor inconsistencies, but the system demonstrated the feasibility of this technique for data acquisition from remote sites.

SR 76-14

NOTES ON CONDUCTING THE BEHAVIOR SETTING SURVEY BY INTERVIEW METHOD.

Ledbetter, C.B., Nov. 1976, 33p., ADA-062 448, 17 refs.
32-1256
ENVIRONMENTS, HUMAN FACTORS, MILITARY FACILITIES.

Practical guidelines for conducting the behavior setting survey by interview method are presented. This training manual for the layperson describes the data, survey forms and interview techniques.

SR 76-15

FATE AND EFFECTS OF CRUDE OIL SPILLED ON PERMAFROST TERRAIN. FIRST YEAR PROGRESS REPORT.

Collins, C.M., et al, Nov. 1976, 18p., ADA-034 140, 3 refs.
Deneke, F.J., Jenkins, T.F., Johnson, L.A., McFadden, T., Slaughter, C.W., Sparrow, E.B.
32-1257
OIL SPILLS, SOIL TEMPERATURE, VEGETATION, PERMAFROST.

The long-term effects and ultimate fate of crude oil spilled on permafrost-underlain tundra is the subject of this study. The project involves two experimental oil spills of 2,000 gallons (7,570 liters) each on 500 sq m test plots near Fairbanks, Alaska. A winter spill, discussed in this progress report, took place in February 1976. Another spill will take place at the peak of the growing season in the summer. This allows conditions prevailing during these climatic periods to be studied as to their effect on oil spills, and makes it possible to study the reaction of the spilled oil to these temperature extremes. The spill discussed in this report was designed to simulate a real pipeline leak, and was large enough to approach reality while remaining within the limits of logistical capabilities. Monitoring of the spill and control plots includes: oil movement, temperature regime, biological effects, microbiological changes, permafrost impact, and chemical degradation of the oil.

SR 76-16

UTILITY DISTRIBUTION SYSTEMS IN SWEDEN, FINLAND, NORWAY AND ENGLAND.

Aamot, H.W.C., et al, Nov. 1976, 121p., ADA-035 088, Bibliography p.116-121.
McFadden, T.
32-1258
UTILITIES, SEWAGE DISPOSAL, ELECTRICITY, HEATING, WATER SUPPLY, SCANDINAVIA, UNITED KINGDOM.

The study reports on new developments and special problems or solutions in water distribution systems, sewage and solid waste transport systems, heat distribution systems and electric transmission systems. Cold weather considerations are highlighted. For water and sewage systems, the use of ductile iron and plastic materials for pipes is reported. The use of heating, insulating or shielding of the pipes for frost protection is of interest. Some developments in tunneling technology were identified. Pneumatic solid waste collection and vacuum sewage collection represent new developments. For heat distribution, the many different types of pipe and insulation systems used are described. Good moisture control in insulation is emphasized. Developments in long distance heat transmission are discussed. With electric distribution, the use of self-supporting aerial cables is a new development. With transmission, problems of icing and countermeasures are discussed.

SR 76-17

ENERGY CONSERVATION IN BUILDINGS.

Ledbetter, C.B., Dec. 1976, 8p., ADA-034 141, 3 refs.
32-1259
HEATING, BUILDINGS, CONSERVATION.

This report scans current building designs and describes, for the layman, ways that buildings could be designed for improved energy consumption. Topics of building design addressed are insulation, thermal bridges, ventilation, orientation, lighting, windows, and solar heat.

SR 76-18

IMPROVED MILLIVOLT-TEMPERATURE CONVERSION TABLES FOR COPPER CONSTANTAN THERMOCOUPLES. 32F REFERENCE TEMPERATURE.

Stallman, P.E., et al, Dec. 1976, 66p., ADA-034 841, 6 refs.
Itagaki, K.
32-1260
TEMPERATURE MEASUREMENT, CONVERSION TABLES.

This report extends and improves the conversion tables already available (CRREL Special Report 108, G.W. Aitken, 1966, 24-3490 (AD-805 751)). The computational method is described with discussion of error, improved methods, and limitations. The tables are presented in two sections: the first for temperatures in the range -184C to 0C, the second for temperatures in the range 0C to 100C. The corresponding Fahrenheit temperatures are also included.

SR 77-01

SELECTED EXAMPLES OF RADIOHM RESISTIVITY SURVEYS FOR GEOTECHNICAL EXPLORATION.

Hoekstra, P., et al, Jan. 1977, 16p., ADA-035 761, 20 refs.
Sellmann, P.V., Delaney, A.J.
32-1275
GEOPHYSICAL SURVEYS, ELECTRICAL RESISTIVITY, PERMAFROST INDICATORS, GRAVEL.

Measurements of ground resistivity using radio wave techniques have been made in support of several geotechnical projects. Examples of surveys conducted for locating and evaluating gravel deposits, for delineating permafrost, and for extrapolating subsurface information between drill holes are used to illustrate some advantages of ground and airborne surveys using this method.

SR 77-02

CRREL ROOF MOISTURE SURVEY, PEASE AFB BUILDINGS 33, 116, 122 AND 205.

Korhonen, C., et al, Jan. 1977, 10p., ADA-035 762.
Tobiasson, W., Dudley, T.
32-1276
ROOFS, MOISTURE, INSULATION, INFRARED EQUIPMENT.

Four building roofs at Pease AFB were surveyed with a hand-held infrared camera to detect wet insulation. Areas of wet insulation on these roofs were marked with spray paint, and 3-in.-diam core samples of the built-up membrane and insulation were taken to verify wet and dry conditions. Flashing defects are considered responsible for most of the wet insulation uncovered in this survey. Recommendations for maintenance, repair, and replacement were developed from the infrared surveys, core samples and visual examinations.

SR 77-03

ESTIMATING HEATING REQUIREMENTS FOR BUILDINGS UNDER CONSTRUCTION IN COLD REGIONS—AN INTERACTIVE COMPUTER APPROACH.

Bennett, F.L., Feb. 1977, 113p., ADA-035 709, 65 refs.
32-1277
COLD WEATHER CONSTRUCTION, BUILDINGS, HEATING, HEAT LOSS, COMPUTER PROGRAMS.

The paper documents a review of construction literature to find reports of projects constructed under low-temperature conditions. A survey of Alaskan contractors to determine "cutoff temperatures" and other factors that cause suspension of various construction works is also presented. For both the literature search and the contractor survey, the lowest temperature mentioned was -70F. The paper also describes a computer program for estimating heat loss and enclosures and heating costs for buildings under construction in cold regions. The program is described, a sample program run is presented, and a successful validation effort is summarized.

SR 77-04

HAINES-FAIRBANKS PIPELINE: DESIGN, CONSTRUCTION AND OPERATION.

Garfield, D.E., et al, Feb. 1977, 20p., ADA-038 445, 20 refs.
Ashline, C.E., Haynes, F.D., Ueda, H.T.
32-1278
PIPELINES, MAINTENANCE, CONSTRUCTION, UNITED STATES—ALASKA.

This report is intended to provide a background for the analysis and evaluation of new pipelines being built in cold regions. Topics discussed include the initial design, construction, testing, operation and maintenance of, and modifications to, the 8-in. pipeline from the deep water port of Haines to military installations at Fairbanks, Alaska. The 626-mile multi-product pipeline began operation in 1956. The results of a corrosion survey completed in 1970 indicated that extensive renovation would be required to continue operations, and the section from Haines to Eielson Air Force Base was closed in 1973.

SR 77-05

GUIDELINES FOR ARCHITECTURAL PROGRAMMING OF OFFICE SETTINGS.

Ledbetter, C.B., Mar. 1977, 14p., ADA-037 124, 2 refs.
32-1279
ENVIRONMENTAL TESTS, HUMAN FACTORS ENGINEERING, BUILDINGS.

A demonstration of Barker's K-21 test for identifying and differentiating behavior settings is presented as a means of diagnosing problems in an office environment. Guidelines for rearranging the layout of an organization's offices are developed that could also be used for architectural programming for a new building if the organization were to be relocated. As an instructional program, the demonstration presented here shows how to conduct the K-21 test in order to analyze problems concerning behavior setting boundaries or conflicts between behavior settings.

SR 77-06

SYMPOSIUM: GEOGRAPHY OF POLAR COUNTRIES; SELECTED PAPERS AND SUMMARIES.

Brown, J., ed, Mar. 1977, 61p., ADA-038 379, In English and Russian. Numerous refs. For selected papers see 32-1302 through 32-1306.

32-1301

MEETINGS, LAND DEVELOPMENT, ENVIRONMENTAL PROTECTION.

The symposium on Geography of Polar Countries held in Leningrad 22-26 July 1976 as part of the XXIII International Geographical Congress consisted of three sessions: (1) Polar environment, natural resources, their exploration and exploitation; (2) Past, present and future economic developments in the polar regions; (3) Polar environment protection. This report presents the full text or extended summaries of a number of the U.S. papers, and English and Russian summaries of the Soviet contributions related to environmental protection. The papers and summaries presented in this report reflect the participation of members and of the joint US-USSR environmental protection agreement project, *Protection of Northern Ecosystems.* The U.S. papers deal with land use planning to mitigate environmental impact: the impact of resource development on natives, fish and wildlife, and permafrost, the impacts of pipelines and roads on the environment, and computer modeling to simulate terrain modification due to man's activities. The Soviet summaries deal with subjects of properties and changes in arctic and subarctic flora, treeline, and permafrost, and methods of predicting changes in the environment.

SR 77-07

SELECTED BIBLIOGRAPHY OF DISTURBANCE AND RESTORATION OF SOILS AND VEGETATION IN PERMAFROST REGIONS OF THE USSR (1970-1976).

Andrews, M., Mar. 1977, 116p., ADA-051 813.

32-2728

BIBLIOGRAPHIES, CRYOGENIC SOILS, REVEGETATION, LAND RECLAMATION.

The literature is discussed in chronological fashion, with general statements followed by highlights of each year's contributions (with three tables and two appendices for amplification). The years 1972 and 1973 produced the most publications, and by 1975 there was a noticeable lag in pickup of publications by the indexing services. A trend is apparent from a reconnaissance and description approach in earlier papers toward an integrated ecosystem approach in more recent publications. Increased consciousness of the effects of disturbance on the permafrost environment, and the importance of restoration and preservation of these environments, are reflected in the recent literature, particularly in symposium proceedings.

SR 77-08

REVEGETATION AND EROSION CONTROL OBSERVATIONS ALONG THE TRANS-ALASKA PIPELINE—1975 SUMMER CONSTRUCTION SEASON.

Johnson, L.A., et al, Mar. 1977, 36p., ADA-038 416.
Quinn, W.F., Brown, J.

32-1311

PIPELINES, SOIL EROSION, EROSION CONTROL, PROTECTIVE VEGETATION.

Procedures for revegetation and erosion control of the Trans-Alaska Pipeline System during the initial construction phase are reviewed. Fertilizer and seed rates and schedules of application by major areas (sections) are presented. During the field season of 1975 CRREL personnel observed revegetation and erosion control practices along the entire length of the pipeline route. The types of problems and early successes are discussed. Thirty-eight photographs are presented of characteristic areas on which revegetation was initiated. A list of sites for follow up observations is presented.

SR 77-09

INFRARED THERMOGRAPHY OF BUILDINGS: AN ANNOTATED BIBLIOGRAPHY.

Marshall, S.J., Mar. 1977, 21p., ADA-038 447, 42 refs.

32-1312

BIBLIOGRAPHIES, BUILDINGS, THERMAL ANALYSIS, INFRARED RADIATION.

This report summarizes a review of the current literature on the new subject of infrared thermography of buildings. Infrared thermography of buildings (IRTB) uses a thermal imaging scanner to detect heat loss, structural defects, moisture, and other anomalies in building envelopes. Photographs of the imagery called thermograms provide hard copy documentation of faults detected. Thirty-four references are abstracted, covering research and development, roof moisture surveys, and qualitative/quantitative field surveys. The readily obtainable sources were chosen for their practical approach to providing potential users who are not scientifically oriented with an opportunity to quickly grasp the value of this new technology.

SR 77-10

COMPUTER ROUTING OF UNSATURATED FLOW THROUGH SNOW.

Tucker, W.B., et al, May 1977, 44p., ADA-040 121.
Colbeck, S.C.

32-1313

SNOW COVER, WATER FLOW, SNOWMELT, COMPUTER PROGRAMS.

Computer programs for routing the vertical movement of water through snow have been developed. The shock front is dependent on surface melt taking place now as well as the antecedent flow in the snow, usually a function of the nature of the flow for the previous day. One program, designed to accommodate actual surface melt data, has the ability to handle complicated input profiles such as when melt is erratic on a cloudy day, creating such complexities as intersecting shock fronts. Another program, designed for rapid simulation purposes, approximates a simple surface input with a function, in this case a sine wave. This function is easily changed, allowing a variety of conditions to be assessed, although only one shock front is accommodated. Error analysis and some applications of the programs are presented.

SR 77-11

DEMONSTRATION OF BUILDING HEATING WITH A HEAT PUMP USING THERMAL EFFLUENT.

Sector, P.W., May 1977, 24p., ADA-041 024, 13 refs.

32-1314

HEAT RECOVERY, HEATING, BUILDINGS, COST ANALYSIS, HEAT PUMPS.

This report describes efforts made to recover waste heat and to reuse it to heat a building. A heat pump, which is a refrigeration device, was operated to provide building heat and to demonstrate both economic benefits and energy savings possible with this type of heating system. Heat pump fundamentals and system design considerations supplement the report of this demonstration project. Operational characteristics were monitored and are reported. A 25% reduction in heating costs was observed compared with an oil-fired system. The author recommends that the minimum coefficient of performance should be 3.4 for a cost effective, energy-conservative heat pump heating system.

SR 77-12

LABORATORY STUDIES OF COMPRESSED AIR SEEDING OF SUPERCOOLED FOG.

Hicks, J.R., et al, May 1977, 19p., ADA-040 633, 3 refs.
Rice, R.C., Jr.

32-1315

SUPERCOOLED FOG, CLOUD SEEDING, LABORATORY TECHNIQUES.

Some 400 tests were conducted in the CRREL cold cloud chamber to determine the combination of air pressure and nozzle design that yielded the maximum production of ice crystals in a supercooled fog. It was found that some 0.22 cu m/min of air which was compressed to 517 kPa is needed to be effective for clearing a supercooled fog.

SR 77-13

STAKE DRIVING TOOLS: A PRELIMINARY SURVEY.

Kovacs, A., et al, May 1977, 43p., ADA-041 053, 9 refs.
Atkins, R.T.

32-1316

ANCHORS, FROZEN GROUND, DRILLS, PILE DRIVING, HAMMERS.

This report gives results of a study of four commercial breaker-rock drills, a prototype hydraulic stake driver-retriever and a prototype propellant-actuated hammer which were evaluated for driving anchors into hard frozen ground. The tests found that commercial breaker-rock drills can be used without modification to drive standard military GP-112/G and GP-113/G stakes into frozen ground. The study revealed that while the hydraulic stake driver would require further development to increase its reliability, it could drive the above stakes into frozen ground. The propellant-actuated stake driver was found incapable of driving stakes into hard frozen ground and was not considered worthy of further development as a stake driver.

SR 77-14

RUNWAY SITE SURVEY, PENSACOLA MOUNTAINS, ANTARCTICA.

Kovacs, A., et al, June 1977, 45p., ADA-051 814, 6 refs.
Abele, G.

32-1317

SITE SURVEYS, AIRCRAFT LANDING AREAS, ICE RUNWAYS, ANTARCTICA—PENSACOLA MOUNTAINS.

Two blue ice areas were surveyed in the Pensacola Mountain region of Antarctica and found suitable for runway sites. A length of 2.5 to 3 km, oriented in the predominant wind direction, is available at Rosser Ridge, requiring very little snow removal. A length of 3 km, oriented at 30 deg to 45 deg with the predominant wind direction, is available at Mt. Lechner, but considerable snow removal would be required, and some obstacles are present near both ends of the runway area. Aerial inspection disclosed one and probably two more suitable sites near the Patuxent Range.

SR 77-15

KOLYMA WATER BALANCE STATION, MAGADAN OBLAST, NORTHEAST U.S.S.R.: UNITED STATES-SOVIET SCIENTIFIC EXCHANGE VISIT.

Slaughter, C.W., et al, May 1977, 66p., ADA-041 606, 16 refs. For a shorter version see Arctic bulletin, 1978, 2(13), p.305-313.
Bilello, M.A.

32-1318

WATER BALANCE, STATIONS, RESEARCH PROJECTS, INTERNATIONAL COOPERATION, USSR—MAGADAN.

Two U.S. scientists visited Kolyma Water Balance Station (KWBS) in Magadan Oblast of northeast USSR during the last two weeks of August 1976. Under the auspices of the Joint USA-USSR Agreement on Cooperation in the Field of Environmental Protection, this trip was undertaken to review current Soviet watershed hydrology research in a permafrost dominated setting similar to that of central Alaska. Research objectives, instrumentation, and field practices were observed and discussed at KWBS. A series of proposals for future cooperation in high latitude hydrology research and data exchange was prepared.

SR 77-16

COMPOSITION OF VAPORS EVOLVED FROM MILITARY TNT AS INFLUENCED BY TEMPERATURE, SOLID COMPOSITION, AGE AND SOURCE.

Leggett, D.C., et al, June 1977, 25p., ADA-040 632, 19 refs.
Jenkins, T.F., Murrmann, R.P.

32-1319

EXPLOSIVES, IMPURITIES, VAPOR PRESSURE, CHEMICAL ANALYSIS.

A number of domestic and foreign military TNT samples were analyzed by a gas chromatographic headspace technique. The method allowed the determination of the vapor pressure of TNT and the partial pressures of several associated impurities over a 2 to 32C temperature range. A major volatile impurity in all U.S. military TNT samples was 2,4-dinitrotoluene, which had a partial pressure 1 to 2 orders of magnitude higher than the vapor pressure of TNT. The experimental data followed a Clausius-Clapeyron temperature dependence for the vapor pressure of TNT, and the partial pressure of DNT was related to its concentration in the solid by a Henry's constant. Age and source of the TNT were found to have little or no influence on these relationships. The reasons for finding a relatively high DNT partial pressure are discussed, as is its implication for TNT detection by trace gas methods.

SR 77-17

EFFECTS OF LOW-PRESSURE WHEELED VEHICLES ON PLANT COMMUNITIES AND SOILS AT PRUDHOE BAY, ALASKA.

Walker, D.A., et al, June 1977, 49p., ADA-041 593, 11 refs.
Webber, P.J., Everett, K.R., Brown, J.

32-1320

TUNDRA TERRAIN, DAMAGE, ALL TERRAIN VEHICLES, TIRES, TUNDRA VEGETATION, UNITED STATES—ALASKA—PRUDHOE BAY.

An off-road vehicle test utilizing a smooth tired Rolligon weighing approximately 25,000 lb. was conducted at Prudhoe Bay, Alaska, on 25 June 1976. Vehicle impact on the vegetation and terrain was documented at 32 stations selected as representative of the coastal tundra terrain. Twenty-seven stations were of single pass track and five were multiple pass lanes of up to 30 passes. The report documents the impacts with photographs and numerical ratings. Future observations will enable determination of rates of recovery.

SR 77-18

INSTALLATION OF LOOSE-LAID INVERTED ROOF SYSTEM AT FORT WAINWRIGHT, ALASKA.

Schaefer, D., June 1977, 27p., ADA-041 574, 11 refs.

32-1321

ROOFS, INSULATION, COST ANALYSIS.

In the summer 1971 the Corps of Engineers replaced the roof on Building 1053 at Ft. Wainwright, Alaska, with a loose-laid inverted roof system. This roof system was selected to permit an evaluation of its performance and potential suitability for general use in Corps construction. The installation of the roof also permitted an analysis of its construction costs and a record of the construction procedures. Costs were identified in terms of costs of the materials used and the number of man-hours required. For the analysis, the job was broken down into four phases: 1) removal of the existing roofing material and preparation of the deck; 2) application of a surface of plywood decking; 3) placement of the butyl membrane and installation of flashings; and 4) placement of the insulation and ballast pavers. The results show that the installation time requirements compare favorably with those of conventional built-up roofs but the butyl membrane and the pavers cause higher material costs. Advantages are in the maintainability of the roof system and in its increased life expectancy.

SR 77-19

RECLAMATION OF ACIDIC DREDGE SOILS WITH SEWAGE SLUDGE AND LIME AT THE CHESAPEAKE AND DELAWARE CANAL.

Palazzo, A.J., June 1977, 24p., ADA-041 636, Bibliography p.22-24.

32-1322

SOIL ANALYSIS, SOIL CHEMISTRY, SLUDGES, PLANTS (BOTANY), VEGETATION.

A field study was conducted to assess the effects of sewage sludge and lime on the revegetation and reclamation of acidic (pH 3.0) and infertile dredge soils. Sewage sludge at 100 metric tons/ha and lime at 25 metric tons/ha were applied during the summer of 1974 on a seven hectare site and plowed into the soil to a depth of 20 cm. Soils were sampled 20 months after sludge incorporation at three depths, 0-20, 20-40, and 40-60 cm within the sludged and control areas. A total of 29 grass treatments, containing grasses seeded alone or in combinations, were also evaluated and seven grass types analyzed for mineral composition. Comparisons between the sludged and control areas in the layers from 0-20 cm and below 20 cm were made in terms of changes in soil and plant chemistry, plant utilization of soil minerals, plant adaptability and vigor, and eventual resulting vegetative cover.

SR 77-20

UNCONFINED COMPRESSION TESTS ON SNOW: A COMPARATIVE STUDY.

Kovacs, A., et al, July 1977, 27p., ADA-062 445, 21 refs.

Michitti, F., Kalafut, J.

32-4357

SNOW COMPRESSION, COMPRESSIVE STRENGTH, TESTS.

Results of unconfined compression tests performed on snow from Camp Century, Greenland, using a new self-aligning platen system are compared with tests using a more conventional platen system. The average unconfined compressive test strength was 42% higher for samples tested on the new platen assembly vs the old. Test results indicate that the new platen system provides for better sample alignment and therefore a more uniform load distribution applied to the ends of the sample. The higher strength values obtained with the new platen system are considered more representative of the unconfined compressive strength of the snow tested.

SR 77-21

INVESTIGATION OF SLUMPING FAILURE IN AN EARTH DAM ABUTMENT AT KOTZEBUE, ALASKA.

Collins, C.M., et al, July 1977, 21p., ADA-042 306, 5 refs.

McFadden, T.

32-1323

RESERVOIRS, EARTH DAMS, FROZEN GROUND TEMPERATURE, SETTLEMENT (STRUCTURAL), SUBSIDENCE.

A slumping failure on the upstream side in one area of the water supply reservoir at Kotzebue, Alaska, was investigated. Seven 80-ft (24.4-m) thermocouple strings were emplaced in the dam abutment, and an additional four thermocouple strings were installed behind the dam, extending to a depth of 95 ft (28.9 m) below the bottom of the reservoir. All thermocouples indicated below freezing temperatures at their respective positions. These measurements combined with the drill logs indicate that neither the dam nor the abutment is in immediate danger of failure, but that steps must be taken to stop the sloughing of material in the abutment area. Recommendations are given to accomplish this.

SR 77-22

LOCK WALL DEICING STUDIES.

Hanamoto, B., ed, Aug. 1977, 68p., ADA-044 943, For individual papers see 32-1350 through 32-1352, 31-1800, and 32-1109.

32-1349

ICE REMOVAL, CHANNELS (WATERWAYS), LOCKS (WATERWAYS).

Four methods for removing the ice buildup on navigation lock walls on the Poe Locks at Sault Ste. Marie, Michigan, were investigated: mechanical pneumatic boots, high-pressure water jets, mechanical chain saws, and chemical coatings. Two of the more promising means of ice removal, the chain saw and the chemical coatings, are being developed further so that they may be used as operational aids for lock wall deicing during the winter navigation season.

SR 77-23

ABNORMAL INTERNAL FRICTION PEAKS IN SINGLE-CRYSTAL ICE.

Stallman, P.E., et al, Aug. 1977, 15p., ADA-045 412, 9 refs.

Itagaki, K.

32-1355

CUBIC ICE, ICE PHYSICS, ICE CRYSTAL STRUCTURE, TEMPERATURE EFFECTS, ICE FRICTION.

A series of sharp skewed internal friction peaks were observed during warming of single-crystal ice after cooling below -120C (153K), the cubic-hexagonal transition temperature. The peaks were higher when the strain amplitude was lower. Since handling and annealing strongly affect the occurrence of the skewed peaks, those peaks are probably related to the stacking fault process in hexagonal-cubic transition.

SR 77-24

BRAZIL TENSILE STRENGTH TESTS ON SEA ICE: A DATA REPORT.

Kovacs, A., et al, Aug. 1977, 39p., ADA-044 941, 6 refs.

Kalafut, J.

32-1356

SEA ICE, IMPACT STRENGTH, PENETRATION TESTS.

In March 1970 drop penetrometer tests in sea ice were made by Sandia Laboratories for the U.S. Coast Guard. In support of this study, properties of the sea ice penetrated were measured. The data collected included ice temperature, salinity, brine volume, density and Brazil tensile strength versus depth. The data are presented in this report in both tables and graphs as a permanent data source.

SR 77-25

SOLVING PROBLEMS OF ICE-BLOCKED DRAINAGE FACILITIES.

Carey, K.L., Aug. 1977, 17p., ADA-044 994, 4 refs.

32-1357

SURFACE DRAINAGE, ICE CONTROL, HEATING, SUBSURFACE DRAINAGE.

The report summarizes several processes for ice formation and blockage in culverts, ditches, and subsurface drains. Solutions to ice blockage problems involve ice prevention and ice control, usually the latter. In some cases, culverts can be closed, leading to intentional ponding and storage of ice. Alternatively, flow can be maintained in culverts by heating them electrically, with steam, or with oil-burner heaters. Ditches can also be heated, but it is usually more effective to widen them to provide more storage space for ice, or to install insulating covers. Subsurface drain outlets can be heated, protected with insulating covers, or partially blocked to prevent cold air entry. Ground seepage that forms ice is successfully controlled using ice fences. Design changes, such as more and larger drainage structures, staggered culverts, and channel modifications, are discussed.

SR 77-26

INFRARED THERMOGRAPHY OF BUILDINGS: QUALITATIVE ANALYSIS OF FIVE BUILDINGS AT RICKENBACKER AIR FORCE BASE, COLUMBUS, OHIO.

Munis, R.H., et al, Sep. 1977, 21p., ADA-067 161.

Marshall, S.J.

32-4358

HEAT LOSS, INFRARED PHOTOGRAPHY, BUILDINGS, THERMAL ANALYSIS, THERMAL MEASUREMENTS.

A heat loss survey was performed on five typical Air Force Base buildings with an infrared camera system: two with wood frames and wood clapboards, one with wood frame and aluminum siding, and two of cinder block construction with brick veneer. This report presents thermograms typical of the heat loss problems in each of the five buildings along with a complete explanation of each thermogram. The report is intended to serve as a basis upon which Air Force civil engineers can plan a future retrofit program for the buildings surveyed and write a set of specifications incorporating thermography.

SR 77-27

ICING ON SHIPS AND STATIONARY STRUCTURES UNDER MARITIME CONDITIONS—A PRELIMINARY LITERATURE SURVEY OF JAPANESE SOURCES.

Itagaki, K., Sep. 1977, 22p., ADA-044 792, 8 refs.

32-1358

SHIP ICING, ICE ACCRETION, ICE FORECASTING, TEMPERATURE EFFECTS, SEA SPRAY.

This report reviews Japanese literature on ship icing, including direct measurements of ice accumulated on ship, ice accretion rate and sea spray flux as well as statistical analyses of icing conditions. The report also describes some possibilites of forecasting icing conditions.

SR 77-28

AIRBORNE SPECTRORADIOMETER DATA COMPARED WITH GROUND WATER-TURBIDITY MEASUREMENTS AT LAKE POWELL, UTAH: CORRELATION AND QUANTIFICATION OF DATA.

Merry, C.J., Sep. 1977, 38p., ADA-044 793, Bibliography p.26-29.

32-1359

WATER CHEMISTRY, TURBIDITY, LIGHT TRANSMISSION, SPECTRORADIOMETERS, AERIAL SURVEYS, UNITED STATES—UTAH—LAKE POWELL.

The objective of this study is to correlate and quantify the airborne spectroradiometer multispectral data to ground truth water quality measurements obtained at Lake Powell, Utah, during 1975. A ground truth water sampling program was accomplished during 9-16 June 1975 for correlation to an aircraft spectroradiometer flight. Field measurements were taken of percentage of transmittance, surface temperature, pH and secchi disk depth. Also, percentage of light transmittance was measured in the laboratory for the water samples. In addition, electron micrographs and suspended sediment concentration data were obtained of selected water samples located at Hite Bridge (Mile 171), Mile 168, Mile 150 (along the Colorado River main channel) and Bullfrog Bay (Mile 122). Airborne spectroradiometer spectra were selected which correlated to the same test sites.

SR 77-29

INFRARED THERMOGRAPHY OF BUILDINGS: QUALITATIVE ANALYSIS OF WINDOW INFILTRATION LOSS, FEDERAL OFFICE BUILDING, BURLINGTON, VERMONT.

Munis, R.H., et al, Sep. 1977, 17p., ADA-044 942.

Marshall, S.J.

32-1360

INFRARED PHOTOGRAPHY, THERMAL DIFFUSION, BUILDINGS, HEAT LOSS, WINDOWS.

An interior, infrared thermographic survey of single-pane, aluminum-frame, projected windows was performed to pinpoint locations of excessive infiltration. Infrared thermographic inspection accomplishes this more quickly and more accurately than conventional techniques of studying window infiltration. This report presents 32 thermograms and photographs which in many cases dramatically illustrate infiltrations around the mullion, along the top opening cracks, and under the frame/sill interfaces. Poor glazing seals were easily detected and the exact points of glass/frame leakages were pinpointed. Plumes of warm air on the window glass, rising from the convectors, were dramatically captured by the infrared camera system. In several cases, the plumes were noted 12 ft. above the convectors on the top window panels. Heat loss from the convectors was noted through the walls of the building in thermograms taken from the outside. Several recommendations were prepared for the General Services Administration, owner of this Federal Office Building in Burlington, Vermont.

SR 77-30

PAVEMENT RECYCLING USING A HEAVY BULLDOZER MOUNTED PULVERIZER.

Eaton, R.A., et al, Sep. 1977, 12p. + appends., ADA-046 008, 8 refs.

Garfield, D.E.

32-1361

EXCAVATION, SUBGRADES, PAVEMENT BASES.

Recycling of paving materials is currently gaining acceptance as a means of economic savings in pavement reconstruction or rehabilitation. Pavements having low serviceability indices due to surface irregularities such as cracks, bumps, spalling, potholes, etc., may be broken up to meet specified granular base course gradation requirements and reused as a base for the new surface. The USACRREL developed a permafrost excavating attachment for heavy bulldozers and a prototype test rig was constructed. Tests were conducted on frozen soils, gravels, and ledge. In September 1976, this rig was used to pulverize a flexible pavement on North Main Street in Hanover, N.H., and highway pavement test sections in a CRREL test facility. The resultant processed material did meet Corps of Engineers base course gradation requirements. The machine can process 120 square ft of pavement structure per minute to a depth of 12 inches. The most uniformly graded material was obtained at a drum speed of 15 revolutions per minute. Once the pavement structure is broken down from the solid mass (asphalt concrete pavement), the machine does not further break down or pulverize the aggregate. A minor amount of dust was evident during the operations, but no refinements are recommended.

SR 77-31

EFFECTS OF LOW GROUND PRESSURE VEHICLE TRAFFIC ON TUNDRA AT LONELY, ALASKA.

Abele, G., et al, Sep. 1977, 32p., ADA-062 446, 13 refs.

Brown, J., Brewer, M.C., Atwood, D.M.

32-4359

AIR CUSHION VEHICLES, TRACKED VEHICLES, TUNDRA VEGETATION, VEHICLE WHEELS, ENVIRONMENTAL IMPACT, DAMAGE, PATTERNED GROUND, SOIL MOISTURE.

Traffic tests were conducted with two low pressure tire Rolligon-type vehicles and a small, tracked Nodwell with minimal load for 1, 5, and 10 vehicle passes on relatively dry tundra near Lonely, Alaska. The traffic impact was limited to compression of the vegetation and the organic mat and a maximum terrain surface depression of several cm, with no shearing or disaggregation of the mat.

SR 77-32

AERIAL PHOTOINTERPRETATION OF A SMALL ICE JAM.

DenHartog, S.L., Oct. 1977, 17p., ADA-045 870.

32-1362

ICE JAMS, AERIAL SURVEYS, PHOTOINTERPRETATION.

Aerial photos of a small ice jam on the Pemigewasett River near Plymouth, New Hampshire, were taken three days after the jam and compared with photos taken after the ice went out. The winter photos show a marked and sudden decrease in floe size apparently indicative of faster and longer movement of the ice. The spring photos show a number of shallows and obstructions that apparently had no effect on the ice movement. It is concluded that this jam was caused by a change in slope and subsequent reduction in velocity.

SR 77-33

LAND TREATMENT OF WASTEWATER AT WEST DOVER, VERMONT.

Bouzoun, J.R., Oct. 1977, 24p., ADA-046 300, 12 refs.

32-1363

WASTE DISPOSAL, WATER TREATMENT, SEWAGE TREATMENT.

A general description of a wastewater land treatment system located in a "cold temperate" climatic region is given. The winter season average daily design flow is almost double that of the summer-fall season (0.55 MGD vs 0.30 MGD). Wastewater is sprayed on a forested knoll after it receives secondary biological treatment. The system is operated during the winter when the ambient air temperature is as low as 10F. Spray nozzles have been developed that ensure rapid drainage of the spray laterals after each spray cycle and, therefore, prevent their freezing.

SR 77-34

CANOL PIPELINE PROJECT: A HISTORICAL REVIEW.

Ueda, H.T., et al, Oct. 1977, 32p., ADA-046 707, 8 refs.

Garfield, D.E., Haynes, F.D.

32-1364

PIPELINES, HISTORY, ARCTIC LANDSCAPES.

This report is a historical review of the Canol project, the first long-distance petroleum pipeline system constructed in the Arctic region of North America. The project was initiated during the early days of World War II when the military situation appeared critical. It was designed to supply the military need for fuel in the area, particularly Alaska, by exploiting the Norman Wells oil field in the Northwest Territory of Canada. The system was completed in April 1944 and operated for 11 months converting 975,764 barrels of crude oil into gasoline and fuel oil. Construction for the pioneering effort was difficult and costly. Considerable controversy plagued the project throughout; nevertheless, its completion proved that undertakings of such magnitude could be accomplished despite the formidable problems of the Arctic.

SR 77-35

CEMENTS FOR STRUCTURAL CONCRETE IN COLD REGIONS.

Johnson, R., Oct. 1977, 13p., ADA-046 302, 19 refs.

32-1366

WINTER CONCRETING, CONCRETE ADMIXTURES, CONCRETE STRENGTH, CONCRETE CURING, CEMENTS.

A literature search was undertaken to collect information on cements which could be used in structural concrete and would cure at low temperatures. In the literature search, 18 types of cements or concretes manufactured by various firms were reviewed. Trade names are identified with their cement or concrete description, temperature range for curing, use experience and application, approximate cost (in 1976), and reference source or manufacturer.

SR 77-36

SMALL COMMUNITIES RESULT IN GREATER SATISFACTION: AN EXAMINATION OF UNDERMANNING THEORY.

Ledbetter, C.B., Nov. 1977, 15p., ADA-046 817, 3 refs.

32-1367

HUMAN FACTORS, THEORIES.

Roger Barker's undermanning theory states that the smaller an organization, the greater the degree of undermanning, resulting in greater inhabitant satisfaction. This theory is examined using the National Opinion Research Center's General Social Survey for 1974. Two groups of survey variables were dichotomized and net transmittances or coefficients of correlation for the system were determined. Two groups of variables were chosen: objective groups, such as age and income, and subjective ones, such as sociability and job satisfaction. The only positive correlation found was that people residing in small communities are more satisfied with their community than are people who live in large communities. Only a small portion of this is explained by the degree to which small town inhabitants are satisfied with their financial situation.

SR 77-37

UTILIZATION OF SEWAGE SLUDGE FOR TERRAIN STABILIZATION IN COLD REGIONS.

Gaskin, D.A., et al, Nov. 1977, 45p., ADA-047 368.

Hannel, W., Palazzo, A.J., Bates, R.E., Stanley, L.E.

32-1368

SOIL STABILIZATION, SLUDGES, EROSION CONTROL, SEWAGE, VEGETATION.

A terrain stabilization research/demonstration site was constructed in May 1974 at Hanover, New Hampshire, to investigate various combinations of physical, chemical and biological techniques for terrain stabilization in cold regions. Fourteen test plots (10 x 40 ft) with individual 350 gal tanks to collect sediment were installed on a 16 deg slope. These 14 test plots were to examine the effectiveness of sewage sludge and primary effluent on terrain stabilization in cold regions. In 13 of the 14 plots the variables studied were nutrient source (fertilizer, sludge, and primary wastewater), moisture (irrigated and nonirrigated), erosion control material (jute netting, straw tacked with a tacking compound), no erosion control material and vegetation (three grasses and two legumes). The control plot was left bare of seed, fertilizer and erosion control material for comparison. A 20,000 sq ft area adjacent to the 14 plots was installed for general testing of various combinations of tacking chemicals, plastic netting, straw, and wood fiber mulch. In general, all treatments with the exception of two plots were effective in reducing soil loss in comparison with the control which had a loss of 34,531 lb of soil (dry weight) on a per acre basis.

SR 77-38

FINITE ELEMENT MODEL OF TRANSIENT HEAT CONDUCTION WITH ISOTHERMAL PHASE CHANGE (TWO AND THREE DIMENSIONAL).

Guymon, G.L., et al, Nov. 1977, 167p., ADA-047 369.

Hromadka, T.V., II.

32-1369

THERMAL CONDUCTIVITY, MATHEMATICAL MODELS, COMPUTERIZED SIMULATION, FROZEN GROUND MECHANICS, COMPUTER PROGRAMS.

The partial differential equation for transient heat conduction is solved by a finite element analog using a quadratic weighting function for the discretized spatial domain. The transient problem is solved by the Crank-Nicolson approximation. Two dimensional and three dimensional models incorporated in the same computer program are presented. The finite element method is reviewed, assumptions and limitations upon which the model is based are presented, and a complete derivation of the system analog is included. Certain problems can only be modeled as a three dimensional system, e.g., thaw degradations around roadway culverts, embankment dams on permafrost where dam length is short relative to dam width, and thaw and freezeback under buildings. In most cases, however, the more economical two dimensional model can be used. Numerical tests of both models have been accomplished but field verification has not been attempted. A user's manual and a FORTRAN IV computer listing of the program are presented.

SR 77-39

TEMPORARY PROTECTION OF WINTERTIME BUILDING CONSTRUCTION, FAIRBANKS, ALASKA, 1976-77.

Bennett, F.L., Nov. 1977, 41p., ADA-048 987, 2 refs.

32-2729

COLD WEATHER CONSTRUCTION, BUILDINGS, HEATING.

Nine building construction projects, whose total area exceeds one half million square feet, were under construction in Fairbanks, Alaska, area during the winter of 1976-77. These projects were studied to determine the methods used for providing temporary enclosures and temporary building heating during the construction process. The types of construction activities underway at various temperature conditions are reported, and a record of temperature variations in the buildings under construciton is discussed. Both black and white and color photo documentation was developed, and several black and white photographs are included in this report.

SR 77-40

WINTER EARTHWORK CONSTRUCTION IN UPPER MICHIGAN.

Haas, W.M., et al, Nov. 1977, 59p., ADA-049 052, 5 refs. See also 32-293.

Alkire, B.D., Dingeldein, J.E.

32-2698

EARTHWORK, SUBGRADE PREPARATION, COLD WEATHER CONSTRUCTION, FROZEN GROUND.

Winter earthwork construction was observed in three counties in Michigan's Upper Peninsula during the 1975-76 season. In all cases, construction methods are used which exclude frozen soil from the central core of the embankment, with frozen soil permitted in the outer slope zone. While all projects were technically successful, construction was halted in early February on one project because it was uneconomical for the contractor to continue. On another project, the contractor successfully exploited soil freezing to form stable smooth haul roads for his scrapers. Most of the work consisted of raising the grade of existing roads by 18 inches of non-frost-susceptible soil to minimize frost heaving and loss of bearing capacity. This winter activity resulted in better utilization of county equipment and work crews.

SR 77-41

1977 CRREL-USGS PERMAFROST PROGRAM BEAUFORT SEA, ALASKA, OPERATIONAL REPORT.

Sellmann, P.V., et al, Dec. 1977, 19p., ADA-048 985, 11 refs. See also 32-1248 (SR 76-12, ADA-032 440).

Chamberlain, E.J., Ueda, H.T., Blouin, S.E., Garfield, D.E., Lewellen, R.I.

32-2697

OFFSHORE DRILLING, DRILL CORE ANALYSIS, SUBSEA PERMAFROST, BOTTOM SEDIMENT, TEMPERATURE MEASUREMENT.

During the spring of 1977 soil samples were obtained in the Prudhoe Bay area from one hole drilled on land and five holes drilled offshore. The study is a continuation of the program started the previous season to examine the engineering characteristics and properties of permafrost under the Beaufort Sea. Emphasis was placed on establishing the range of thermal and physical properties found in this geological setting, which is thought to be common to much of the eastern Alaska coastal zone. Twenty-seven probe sites were selected to determine local engineering properties and temperature conditions, and to aid in interpreting the lithology between the drill holes. Core drilling information from some of the probe sites was used as control for interpreting the probe records. Deep thermal and geological information was obtained from the drill sites by the USGS personnel participating in the study. Maximum drill hole depth was 68.5 m (225 ft) and maximum penetration depth was 15 m (50 ft). The probe temperature data indicated the presence of permafrost in all holes. Probe penetration resistance measurements helped to delineate shallow, ice-bonded zones, some of which may have been only seasonal. In the core study, frozen sediments were found in only one hole at approximately the 29.6-m (97-ft) depth. Fine-grained sediments were more common than course-grained material, and showed general increase in thickness with increasing distance from shore. The only departure from the previous year's field drilling techniques was the use of larger diameter, thick-walled casing and an air-operated casing driver. The probe equipment and techniques employed, however, represented a significant improvement over the prototype equipment used in 1976.

SR 77-42

GROUTING OF SOILS IN COLD ENVIRONMENTS: A LITERATURE SEARCH.

Johnson, R., Dec. 1977, 49p., ADA-049 436, 52 refs.

32-2548

GROUTING, ADMIXTURES, SOIL STRENGTH.

A literature search was undertaken to collect information on grouting of soils as related to low temperature environment, 40 F and below. This report reviews existing literature and the state-of-the-art on conventional grouting engineering methods and materials to seek which may he used in thawed or dry, frozen ground and to establish the need of new methods and techniques where conventional grouting methods fail.

SR 77-43

CRREL ROOF MOISTURE SURVEY, BUILDING 208 ROCK ISLAND ARSENAL.

Korhonen, C., et al, Dec. 1977, 6p., ADA-051 490.

Dudley, T., Tobiasson, W.

32-2730

ROOFS, MOISTURE, INFRARED RADIATION.

The roof of building 208 at Rock Island Arsenal was surveyed for wet insulation using a hand-held infrared camera. Areas of wet insulation were marked with spray paint on the roof and 3-in.-diam core samples of the built-up membrane and insulation were obtained to verify wet and dry conditions. Roof defects uncovered during a visual inspection were also marked with spray paint. The majority of the wet areas detected are associated with flashing flaws, which are considered responsible for the wet insulation. Recommendations for maintenance of this roof are based on information derived from the infrared survey, core samples and visual examinations.

SR 77-44

FATE AND EFFECTS OF CRUDE OIL SPILLED ON PERMAFROST TERRAIN. SECOND ANNUAL PROGRESS REPORT, JUNE 1976 TO JULY 1977.

McFadden, T., et al, Dec 1977, 46p., ADA-061 779, 4 refs. Includes progress report for the first year, CRREL SR 76-15, q.v. 32-1257.

Jenkins, T.F., Collins, C.M., Johnson, L.A., McCown, B.H., Sparrow, E.B.

33-1528

OIL SPILLS, DAMAGE, CHEMICAL REACTIONS, FROZEN GROUND, ENVIRONMENTAL IMPACT, VEGETATION.

This spill was compared with one that took place in February 1976 (reported upon in the first annual progress report). Oil moved downslope at a much faster rate during the summer spill than during the winter spill. In the winter the oil cooled and pooled rapidly. The summer spill covered approximately one-third more surface area than did the winter spill in the final configuration, even though the two spills were of almost identical volume. Increases in microbial populations and activities during the months following the spill were evident. Increased counts of bacteria, yeasts, denitrifying bacteria, and petroleum-degrading bacteria following the spills were particularly evident. Analysis of oil decomposition using gas chromatography techniques indicated that the low molecular weight fractions, methane and etane, were lost almost immediately after the spill in each case. Fractions in the C3 to C9 range were reduced significantly in two months and were nearly zero at the end of five months. An obvious adverse effect on vegetation was noted in both spills. Biological damage from the summer spill appeared to exceed that from the winter spill.

SR 78-01

RECOMMENDATIONS FOR IMPLEMENTING ROOF MOISTURE SURVEYS IN THE U.S. ARMY.

U.S. Army CRREL/WES/FESA Roof Moisture Research Team, Aug. 1978, 8p., ADB-031 978L, Distribution limited to U.S. Government agencies only.

33-1534

MOISTURE METERS, ROOFS, INFRARED RECONNAISSANCE, SITE SURVEYS.

Nuclear, infrared, capacitance, microwave and impulse radar methods for non-destructively detecting moisture in roofs were evaluated. No system was reliable enough by itself or by cross-checking with another system to eliminate the need for a few core samples of membrane and insulation to verify findings. Airborne infrared surveys are a cost-effective way of reconnoitering numerous roofs at a major installation. However, follow-up on-the-roof surveys are necessary. Of the several grid techniques examined, nuclear surveys were the most reliable. Hand-held infrared surveys are the most accurate on-the-roof method studied. Although an infrared camera costs significantly more than a nuclear meter ($25K vs $3K), infrared surveys can be conducted more rapidly. Since the Army has numerous roofs to survey, infrared surveys appear to be the most cost-effective method. For reasons of continuity, accuracy and economy, the Army should establish its own capability to survey roofs for moisture. Implementation should not be at the installation level. A centralized team of roof moisture surveying specialists, skilled in operating infrared equipment but, more importantly, skilled in roofing technology, should be established. The team should both conduct and contract for airborne and on-the-roof infrared surveys. The CRREL/-WES/FESA roof moisture research group has initiated development of training aids for use by such a team.

SR 78-02
ARCHITECTURAL PROGRAMMING: MAKING SOCIALLY RESPONSIVE ARCHITECTURE MORE ACCESSIBLE.

Ledbetter, C.B., Mar. 1978, 7p., ADA-052 153, 6 refs.
32-3537
BUILDINGS, DESIGN.

SR 78-03
PHYSICAL MEASUREMENT OF ICE JAMS 1976-77 FIELD SEASON.

Wuebben, J.L., et al, Mar. 1978, 19p., ADA-053 260, 2 refs.
Stewart, D.M.
32-3538
RIVER ICE, ICE JAMS, ICE COVER THICKNESS, MEASUREMENT.

Three shallow stream ice jams which occurred on the Ottauquechee River in Vermont during the 1976-77 winter season are documented. Measurements of the variation in jam thickness along the longitudinal profile of the jams are given along with the variation in surface ice floe sizes. These measurements are compared with those of previous work. All jams were caused to some extent by backwater conditions in the river. The effects of an ice cover and the ice jams on the longitudinal water surface profiles are examined and compared with open water conditions.

SR 78-04
LARGE MOBILE DRILLING RIGS USED ALONG THE ALASKA PIPELINE.

Sellmann, P.V., et al, Mar. 1978, 23p., ADA-053 536.
Mellor, M.
32-3539
PIPELINES, DRILLING, UNITED STATES—ALASKA.

The requirement for installing more than 70,000 vertical support members along elevated sections of the Alaska Pipeline resulted in an extremely large drilling program. Several large drilling units, some specially designed, including rotary (auger), percussive, and combination rotary-percussive units, were selected for this job. This selection of equipment and techniques provided the potential to drill in all conceivable material types. An examination of these drills in the field, together with product literature, provided some insight into the characteristics of these drills compared with other commercially available drilling units. The pipeline drilling program provided a major impetus for design and development of new equipment in the area of large rotary-percussive and percussive drilling units. The pipeline drills in general showed sound design characteristics in weight, power, thrust, torque, and speed. Many of the auger boring heads could benefit from improvements in shape, angles, cutter position, and in consideration of "the center of the hole" problem. Need for work in this area was indicated by drilling rates, as well as by noticeable improvements in some augers following contractors' field modifications.

SR 78-05
SPECIALIZED PIPELINE EQUIPMENT.

Hanamoto, B., Mar. 1978, 30p., ADA-055 715, 3 refs.
32-4372
PIPELINES, CONSTRUCTION EQUIPMENT, PIPELINE INSULATION, COLD WEATHER CONSTRUCTION, UNITED STATES—ALASKA.

The use of specialized heavy equipment in the construction phase of the 800-mile Trans-Alaska Pipeline is described. The types include equipment used in bending, taping and insulating the 48-in. pipe used for the pipeline. Stretching from Prudhoe Bay on the North Slope and Beaufort Sea to the southern terminal at Valdez on the Prince William Sound and the Gulf of Alaska, the pipeline construction task, with the combination of varied arctic terrain, severe climatic conditions, conservational and and environmental restraints, and rigid scheduling is a project unlike any that has been undertaken before.

SR 78-06
COMPUTER PROCESSING OF LANDSAT DIGITAL DATA AND SENSOR INTERFACE DEVELOPMENT FOR USE IN NEW ENGLAND RESERVOIR MANAGEMENT.

Merry, C.J., et al, Apr. 1978, 61p., ADA-055 762, Refs. p.40-44.
McKim, H.L.
32-4373
RESERVOIRS, REMOTE SENSING, SNOW WATER EQUIVALENT, LANDSAT, FLOODS, WATER SUPPLY, COMPUTER APPLICATIONS.

A preliminary analysis of Landsat digital data using the NASA GISS computer algorithms for a February 11 scene of the upper St. John River Basin, Maine, showed that the total radiance of pixels contained in three snow courses varied from 5.34 to 7.74 mW/sq cm sr for a water equivalent of approximately 24.1 cm (9.5 in.) of water. This correlation between radiance values and water equivalent of the snowpack still needs to be tested. A multispectral signature was developed with an accuracy of 75% for a wetlands category in the Merrimack River estuary. Low-water reservoir and flood water stages were mapped from grayscale printouts of MSS band 7 for October 27, 1972, and July 6, 1973, respectively, for the Franklin Falls reservoir area, New Hampshire. Two snow pillow transducer systems for measuring the water equivalent of the snowpack in northern Maine were interfaced and field tested. A water quality monitor interfaced to the Landsat DCS was field tested in northern Maine and transmitted the following water quality information: pH, dissolved oxygen, river stage, water temperature and conductivity. A thermocouple system was successfully interfaced and field tested at Sugarloaf Mountain, Maine. Temperature data from the surface to a depth of 30 m (100 ft) were transmitted through the Landsat DCS. Also, a tensiometer/transducer system to measure moisture tension and soil volumetric moisture content was successfully interfaced to the Landsat DCS.

SR 78-07
FRESH WATER SUPPLY FOR A VILLAGE SURROUNDED BY SALT WATER—POINT HOPE, ALASKA.

McFadden, T., et al, Apr. 1978, 18p., ADA-054 147, 9 refs.
Collins, C.M.
32-3964
WATER SUPPLY, GROUND WATER, PERMAFROST HYDROLOGY.

Point Hope is a village located on a narrow gravel spit extending *eight miles out into the Bering Sea.* Studies to locate an adequate fresh water source for the village have yielded two possible supplies which will fill the needs of the village. The first is a ground water supply existing on top of the undulating permafrost layer which underlies the gravel spit. This supply consists of several million gallons of water and can be augmented with snow fences which will drift blowing snow into areas where it will drain into the aquifer when it melts. Excess water will overflow the sides of the natural permafrost basin into the ocean on both sides of the spit. The second source is a small lake located approximately four miles from the village. The lake provides water of adequate quality and quantity to be used as a raw water supply; however, this source is not as desirable since it is surface water and supports a higher level of bacterial contamination. In addition, it is a much greater distance from the village, and longer, much more expensive piping would be required to get the water to the village.

SR 78-08
METHODOLOGY FOR NITROGEN ISOTOPE ANALYSIS AT CRREL.

Jenkins, T.F., et al, Apr. 1978, 57p., ADA-054 939, 9 refs.
Quarry, S.T.
32-4374
SOIL CHEMISTRY, WASTE DISPOSAL, ISOTOPE ANALYSIS, NITROGEN ISOTOPES, COMPUTER APPLICATIONS.

This report documents the chronology of events and the procedures employed in developing a nitrogen isotope analysis capability at the U.S. Army Cold Regions Research and Engineering Laboratory. Both the instrumental and wet chemistry procedures are reported to enable others interested in the procedures to obtain useful data. The procedures described have resulted in the ability to measure the 15-N/14-N ratio to a precision of 0.001 atom %, a value easily within the acceptable range for tracer experiments.

SR 78-09
IMPROVED DRAINAGE AND FROST ACTION CRITERIA FOR NEW JERSEY PAVEMENT DESIGN. PHASE 2: FROST ACTION.

Berg, R.L., et al, May 1978, 80p., ADA-055 785, Numerous refs. passim.
McGaw, R.
32-4380
FROST ACTION, PAVEMENTS, FROST HEAVE, DRAINAGE, THERMAL CONDUCTIVITY, FROST PENETRATION, SOIL FREEZING, COMPUTER APPLICATIONS.

Before constructing actual pavements with open-graded drainage layers in New Jersey, the influence of the drainage layer on frost penetration beneath hypothetical pavements was analytically examined. Thermal conductivity values of several New Jersey soils, stabilized drainage layer materials, and pavement samples were measured using the Guarded Hot Plate method or the probe method. Frost penetration depths were computed using the modified Berggren equations. Mean air freezing indexes used in the computation ranged from 50 deg-days in Atlantic City to 480 deg-days in Newton. Design freezing indexes ranged from 250 deg-days to 900 deg-days for the same two sites. Maximum computed frost depths ranged from 0.8 to 2.1 ft beneath conventional pavements, i.e., those without drainage layers. For pavements incorporating an open-graded drainage layer, computed maximum frost depths ranged from 0.8 ft to 1.4 ft. It was concluded that frost penetration beneath a pavement including an open-graded drainage layer would be approximately equal to a pavement without the drainage layer at the same site.

SR 78-10
1977 TUNDRA FIRE AT KOKOLIK RIVER, ALASKA.

Hall, D.K., et al, Aug. 1978, 11p., ADA-062 439, 10 refs. For this paper from another source see MP 1125, 32-4577.
Brown, J., Johnson, L.A.
35-2591
TUNDRA, FIRES, VEGETATION, DAMAGE, THAW DEPTH, REMOTE SENSING, SPACEBORNE PHOTOGRAPHY, LANDSAT.

During summer 1977 widespread fires occurred in northwest Alaska. Through the use of Landsat imagery and ground studies, one such fire, at Kokolik River was examined. The Kokolik fire was first reported on 26 July, and by the time it was extinguished had consumed 44 sq km of tundra vegetation. Streams and drainages contained the fire on several sides. Ground observations provided information on the intensity of the fire effects. Depth of thaw by late August measured 35.4 cm in the burned areas and 26.6 cm in the unburned areas.

SR 78-11
CONSTRUCTION EQUIPMENT PROBLEMS AND PROCEDURES: ALASKA PIPELINE PROJECT.

Hanamoto, B., June 1978, 14p., ADB-029 226, 4 refs. Distribution limited to U.S. Government agencies only.
33-1535
COLD WEATHER PERFORMANCE, CONSTRUCTION EQUIPMENT, PIPELINES, ENGINES, HUMAN FACTORS.

The Trans-Alaska pipeline construction project posed many problems which are not encountered in the more temperate regions. Construction equipment maintenance and operation is of major concern in the far north. Difficulties encountered were due to: extreme low temperature of -70F (-57C) and common winter temperatures of -30F (-34C), the remoteness and isolation of the work area, harsh environment, and the working personnel. This report describes some of the typical problems encountered with construction equipment on this project and some of the remedies and procedures for solving these problems.

SR 78-12
SOIL LYSIMETERS FOR VALIDATING MODELS OF WASTEWATER RENOVATION BY LAND APPLICATION.

Iskandar, I.K., et al, June 1978, 11p., ADA-059 994, 12 refs.
Nakano, Y.
33-1536
MOISTURE METERS, WATER TREATMENT, WASTE DISPOSAL, MODELS.

This report describes the construction, operation and performance of large-scale (90 cm-inside diameter and 150-cm-high) lysimeters. These lysimeters can continuously monitor soil moisture flow, soil temperature and redox potential with depth, and sample soil water and soil air with depth. The rate of soil water movement to the groundwater was continuously monitored by a rain gage and a recorder. To simulate field conditon, an automatic spray system was developed; this system is also described in this report. The total cost of one lysimeter is approximately $650 (1975 estimate). The lysimeters are being used to validate a biophysical-chemical model of wastewater renovation by application to land. Detailed blueprints of the lysimeters are kept at CRREL and are available on request.

SR 78-13
ECOLOGICAL BASELINE INVESTIGATIONS ALONG THE YUKON RIVER-PRUDHOE BAY HAUL ROAD, ALASKA.

Brown, J., ed, Sep. 1978, 131p., ADA-060 255, For this item as a progress report to the U.S. Department of Energy and for individual papers see 32-3888 through 32-3896.
33-1537
RESEARCH PROJECTS, ECOLOGY, TUNDRA VEGETATION, ROADS, CLAY SOILS.

Results of the first full year's field research on five projects along the Yukon River-Prudhoe Bay Haul Road are reported. Several projects are extensions of investigations begun in 1976 and are being conducted in cooperation with a Federal

Highway Administration sponsored environmental engineering study. The extent and success of weeds and weedy species along the road and in material sites has been followed for summer 1976 and 1977. In order to document the vegetation along the complex elevational and latitudinal gradient and its potential for impact and recovery, 17 vegetation maps have now been completed, and vegetation described and plots established at 120 locations along the 600-kilometer-long road. Collections of vascular plants, bryophytes and lichens were made and catalogued for an additional 9 sites. Sampling for soil invertebrates to determine their sensitivity to impact was undertaken at approximately 25 sites. A detailed study of the impact of road dust upon the vegetation was initiated at one tundra site, and four sites were established to monitor the amount of dust transported onto the tundra across 1000-meter-long transects. The clay mineralogy and chemistry of the dust and road material were investigated.

SR 78-14

GEOCHEMISTRY OF SUBSEA PERMAFROST AT PRUDHOE BAY, ALASKA.

Page, F.W., et al, Sep. 1978, 70p., ADA-060 434, Refs. p.62-68.

Iskandar, I.K.

33-1543

SUBSEA PERMAFROST, SEDIMENTS, SEA WATER, CHEMICAL ANALYSIS, DRILL CORE ANALYSIS, SALINITY.

The analytical data from sediment, interstitial water, and seawater analyses of samples collected near Prudhoe Bay, Alaska, during the period from March to May 1977, are presented. Analyses include determinations of moisture, calcium carbonate, and organic carbon contents in the sediment samples and pH, electrical conductivity, alkalinity, and concentrations of sodium, potassium, calcium, magnesium, chloride, and sulfate in the interstitial water and seawater samples. Salinity, ionic balance, and freezing point of the water samples were calculated. The marine sediments in Prudhoe Bay generally contain more calcium carbonate, organic carbon, and interstitial water than the underlying glacial and fluvial gravels. On land, a surficial layer of peat also had high organic carbon and moisture contents. The salinity of the seawater samples varied from concentrated brines near the shore where sea ice is frozen directly to, or is located near, the sea bottom to water which was 1.0 to 1.5 ppt less saline than normal seawater at a distance of approximately 10 to 15 km from shore.

SR 78-15

WATERPROOFING STRAIN GAGES FOR LOW AMBIENT TEMPERATURES.

Garfield, D.E., et al, Sep. 1978, 20p., ADA-061 749, 10 refs.

McLain, B.G.

33-1544

STRAIN MEASURING INSTRUMENTS, LOW TEMPERATURE TESTS, FREEZE THAW CYCLES, WATERPROOFING.

Due to recent problems experienced with strain-gage based transducers immersed in water at below-freezing ambient temperatures, a test program was conducted to determine if commercially available strain-gage waterproofing systems could withstand these conditions. A total of 96 combinations of eight waterproofing systems, three beam materials and four strain gage adhesives were evaluated. Test environments included strain cycling at temperatures from +32F to +75F and freeze-thaw cycling from -35 to +90F. Only one waterproofing system withstood all tests with no failures. Other results ranged from one installation failure on three systems to the failure of all 12 installations of one system.

SR 78-16

EFFECTS OF LOW GROUND PRESSURE VEHICLE TRAFFIC ON TUNDRA AT LONELY, ALASKA.

Abele, G., et al, Sep. 1978, 63p., ADA-061 777, 18 refs.

Walker, D.A., Brown, J., Brewer, M.C., Atwood, D.M.

33-1545

TUNDRA VEGETATION, TIRES, SOIL TRAFFICABILITY, DAMAGE.

Traffic tests were conducted with two low-pressure-tire Rolligon-type vehicles and a small, tracked Nodwell for 1,5, and 10 vehicle passes on tundra near Lonely, Alaska. The traffic impact was limited to compression of the vegetation and the organic mat and a maximum terrain surface depression of several centimeters, with virtually no shearing or disaggregation of the mat. After one year, the visibility of the traffic signatures had increased, surface depression remained the same, and the thaw depth below the multiple pass tracks had increased a few centimeters.

SR 78-17

EFFECTS OF WINTER MILITARY OPERATIONS ON COLD REGIONS TERRAIN.

Abele, G., et al, Sep. 1978, 34p., ADA-061 260.

Johnson, L.A., Collins, C.M., Taylor, R.A.

33-1546

COLD WEATHER OPERATION, MILITARY OPERATION, DAMAGE, ENVIRONMENTAL IMPACT, VEGETATION.

Observations were made on the 1977 winter military maneuver sites south of Fairbanks to obtain base line data for monitoring terrain and vegetation recovery from the impact of winter trail preparation, and vehicular and troop activities in various terrains and vegetation types.

SR 78-18

GUIDE TO THE USE OF 14N AND 15N IN ENVIRONMENTAL RESEARCH.

Edwards, A.P., Sep. 1978, 77p., ADA-060 385.

33-1768

WASTES, WATER CHEMISTRY, ISOTOPIC LABELING, RESEARCH PROJECTS.

The fate of the mineral nitrogen in wastewater can be established only through natural or artificial stable isotopic labeling. This report assesses the possibilities and problems associated with such tracer techniques applied to the small amounts of nitrogen normally present after secondary waste treatment. The methods outlined for sample processing to minimize analytical errors are applicable to other types of environmental research involving isotope ratio analysis as a means of tracing nitrogen in the biosphere.

SR 78-19

SELECTED BIBLIOGRAPHY OF DISTURBANCE AND RESTORATION OF SOILS AND VEGETATION IN PERMAFROST REGIONS OF THE USSR (1970-1977).

Andrews, M., Oct. 1978, 175p., ADA-062 339.

33-2520

BIBLIOGRAPHIES, HUMAN FACTORS, ENVIRONMENTAL IMPACT, CONTINUOUS PERMAFROST, DISCONTINUOUS PERMAFROST, REVEGETATION, CRYOGENIC SOILS, DAMAGE.

This compilation of literature, published in Russian since 1970, comprises 1225 bibliographic citations relating to disturbance and restoration of soils and vegetation. Sixty-five percent of these were found by a manual search of CRREL Bibliography Vols. 25-32; the others were obtained through off-line searches from the relevant computerized data bases and personal files. Only one of these data bases, that of the National Agricultural Library, is shown to be of significance in providing a valuable checking source. The literature is discussed in chronological fashion, with general statements followed by highlights of each year's contributions. The years 1972 and 1973 produced the most publications, and by 1976 there was a noticeable lag in pickup of publications by the indexing services. A trend is apparent from a reconnaissance and description approach in earlier papers toward an integrated ecosystem approach in more recent publications. Increased consciousness of the effects of disturbance on the permafrost environment, and the importance of restoration and preservation of these environments, are reflected in the recent literature, particularly in symposium proceedings.

SR 78-20

EFFECTS OF WASTEWATER AND SEWAGE SLUDGE ON THE GROWTH AND CHEMICAL COMPOSITION OF TURFGRASS.

Palazzo, A.J., Nov. 1978, 11p., ADA-061 878, 17 refs.

33-1349

WASTE DISPOSAL, SEWAGE DISPOSAL, GRASSES, GROWTH, CHEMICAL COMPOSITION.

A greenhouse study was conducted to determine the effects of wastewater and sewage applications on the growth and chemical composition of two turfgrass mixtures. A mixture of tall fescue and annual ryegrass was compared to a mixture of Kentucky bluegrass, red fescue and annual ryegrass. The mixtures were grown in pots of Chariton silt loam in a greenhouse. Prior to seeding, soil in some pots was amended with sludge at rates of 45 or 90 g/pot. Commercial fertilizer supplying N, P, and K was incorporated with soil in pots designated as controls. Treated municipal wastewater was applied on unamended and sludge-amended soil at rates of 5 or 10 cm per week. Wastewater and sludge treatment increased yields, and total uptake of N, P, K, Zn, Cd, P, Cu, and Ni by the turfgrasses differed by treatment. The two grass mixtures were similar with regard to yields and composition. Larger yields corresponded to greater plant uptake of N, P, K, and metals.

SR 78-21

CLIMATIC SURVEY AT CRREL IN ASSOCIATION WITH THE LAND TREATMENT PROJECT.

Bilello, M.A., et al, Nov. 1978, 37p., ADA-062 518, 39 refs.

Bates, R.E.

33-1542

MICROCLIMATOLOGY, WASTE DISPOSAL, WATER TREATMENT, WASTE TREATMENT, METEOROLOGICAL DATA.

During 1972, six test cells were constructed at CRREL for the purpose of studying application of wastewater on various soil types and vegetation. In conjunction with this program, a meteorological observing station was established in order to obtain basic information on the climate proximate to the test cells. This report describes the equipment and its installation, and provides a daily tabulation of the following observed parameters: maximum and minimum air temperatures, relative humidity, dew point, wind speed and direction, precipitation amounts, depth of snow on the ground, solar radiation and pan evaporation. The meteorological data collected during the period starting Oct. 1, 1972, to Mar. 31, 1974, were then summarized; and the results are presented in a series of graphs and line diagrams. The meteorological parameters recorded at CRREL were then examined to determine how weather can constrain or help year-round operation of wastewater application to the land. The positive and negative effects of air temperature, precipitation, wind speed, evaporation and snow cover, with respect to land treatment of wastewater, were evaluated. Although no specific recommendations or conclusions are given, the influences of these climatic elements as observed at the CRREL wastewater site are presented for consideration.

SR 78-22

COMPUTER FILE FOR EXISTING LAND APPLICATION OF WASTEWATER SYSTEMS: A USER'S GUIDE.

Iskandar, I.K., et al, Nov. 1978, 24p., ADA-062 658, 4 refs.

Robinson, D., Willcockson, W., Keefauver, E.

33-2521

WASTE DISPOSAL, WATER TREATMENT, COMPUTER PROGRAMS.

Two computer programs, both written in BASIC, have been developed to store and retrieve information on existing wastewater land treatment systems. The purpose of establishing these programs is to provide assistance to design engineers during the planning of new land treatment systems by making available the design criteria and performance characteristics of operating systems. The SEARCH program is designed to locate systems with specific design parameters, such as flow rate, waste type, application rate and mode, ground cover and length of operation. The printout from SEARCH includes a list of articles on similar systems in addition to the design parameters. The UPDATE program is used for the revision of information on file. Currently, there are about 350 domestic and 75 foreign systems on file.

SR 78-23

ENGINEERING ASPECTS OF AN EXPERIMENTAL SYSTEM FOR LAND RENOVATION OF SECONDARY EFFLUENT.

Nylund, J.R., et al, Nov. 1978, 26p., ADA-062 923.

Larson, R.E., Clapp, C.E., Linden, D.R., Larson, W.E.

33-2522

WASTE DISPOSAL, WATER TREATMENT, WASTE TREATMENT, IRRIGATION, LAND RECLAMATION.

A research system was designed and installed at the Apple Valley Wastewater Treatment Plant, two miles south of Rosemount, Minnesota, to develop agricultural management practices for removal of nitrogen from municipal wastewater effluent. A solid set irrigation system was designed and installed to apply wastewater effluent to 12 test blocks, each measuring 60 x 150 ft. A perforated plastic drainage tile was placed lengthwise in each block at a depth equivalent to the normal water table level and opening at one end of the block into a sampling station. Six blocks were planted to corn and six planted to eight species of forages. The effluent was applied at rates up to 15 ft/yr. This report presents the engineering considerations in the design of a solid set irrigation system and drain tile and monitoring system for evaluating the influence of the effluent application and agronomic practices on drainage waters.

SR 78-24

ROOF CONSTRUCTION UNDER WINTERTIME CONDITIONS: A CASE STUDY.

Bennett, F.L., Nov. 1978, 34p., ADA-062 519.

33-1541

ROOFS, COLD WEATHER CONSTRUCTION, INSULATION, CONSTRUCTION MATERIALS.

This report describes construction of the roof of an addition to the Interior City Branch of the First National Bank of Anchorage, located in downtown Fairbanks, Alaska, during the 1976-77 winter. The report documents the schedule and procedure for building the roof, reports successful performance of the roof to date, and presents some general comments on roof construction in the wintertime.

SR 78-25

INCREASING THE EFFECTIVENESS OF SOIL COMPACTION AT BELOW-FREEZING TEMPERATURES.

Haas, W.M., et al, Nov. 1978, 58p., ADA-062 875, 57 refs.

Alkire, B.D., Kaderabek, T.J.

33-2523

SOIL COMPACTION, FROZEN GROUND COMPRESSION, COMPRESSIVE STRENGTH, SOIL WATER, CHEMICAL REACTIONS.

This report presents data from an experimental program undertaken to determine the effect of low temperatures on the compaction characteristics of a silty sand. The effects of compactive effort and chemical additives were also investigated to determine possible methods of improving the densities of soils placed and compacted at low temperatures. A single soil type was used throughout the test program, and test results were obtained using Standard and Modified AASHO compactive efforts on an untreated soil prepared and tested at temperatures of 20C and -7C. Additional test series, using the same compactive efforts and temperatures, were performed on the soil after it had been treated with an additive. The amounts of additive used, based on the dry weight of soil, were 3, 2, 1, 0.5, and 0.25% of calcium chloride and 0.5% of sodium chloride. From the results of the experimental program, several important conclusions concerning the effect of low temperature compaction were drawn.

SR 78-26

FIVE-YEAR PERFORMANCE OF CRREL LAND TREATMENT TEST CELLS; WATER QUALITY PLANT YIELDS AND NUTRIENT UPTAKE.

Jenkins, T.F., et al, Nov. 1978, 24p., ADA-086 172, 6 refs.

Palazzo, A.J., Schumacher, P.W., Keller, D.B., Graham, J.M., Quarry, S.T., Hare, H.E., Bayer, J.J., Foley, E.S.

34-3449

LAND RECLAMATION, WASTE TREATMENT, WATER TREATMENT, WASTE DISPOSAL.

The performance of the six land treatment cells is summarized over a five-year period from June 1937 through May 1978. The data presented include quality and volume of wastewater applied and percolate resulting from application of primary and secondary wastewater by spray irrigation. Mass loadings and removals are presented as well as crop production and nutrient uptake. Nutrient balance sheets are shown which demonstrate the percentage of nitrogen and phosphorus that is attributed to crop uptake and leachate over this period.

SR 78-27

CONSTRUCTION AND PERFORMANCE OF PLATINUM PROBES FOR MEASUREMENT OF REDOX POTENTIAL.

Blake, B.J., et al, Nov. 1978, 8p., ADA-062 426, 2 refs.

Brockett, B.E., Iskandar, I.K.

33-1596

SOIL WATER, PROBES, MEASURING INSTRUMENTS.

A simple method is described for construction and testing of platinum oxidation-reduction probes in the laboratory. The probes are "blacked" with platinic chloride to increase their lifetime. Methods of standardization and problems encountered are discussed.

SR 78-28

WASTEWATER STABILIZATION POND LININGS.

Middlebrooks, E.J., et al, Nov. 1978, 116p., ADA-062 903, Refs. p.63-66.

Perman, C.D., Dunn, I.S.

33-2524

WASTE DISPOSAL, WATER TREATMENT, STABILIZATION, PONDS, LININGS, SEALING, SEEPAGE.

A review of the literature on wastewater stabilization lagoon linings, covering the work during the past 20 years, is presented. Design, operating and maintenance experiences are presented for soil sealants, natural sealants, bentonite clays, chemical treatments, gunite, concrete, asphaltic compounds, plastics and elastomers. The characteristics of various materials, applicability to different wastes, construction techniques and details of installation techniques are presented. Installation costs for various materials and comparative costs are summarized. A summary of reported seepage rates for various types of lining materials is presented. A survey of the 50 states was conducted to determine the requirements for liners and allowable seepage rates. Requirements are varied and depend upon the local soil conditions and the experiences of the regulatory agencies with various materials. The trend is toward more stringent requirements. Accepted design and installation procedures are summarized, and detailed drawings of installation techniques are presented. Recommendations of the manufacturers and installers of liners are also presented.

SR 78-29

SUMMARY OF CORPS OF ENGINEERS RESEARCH ON ROOF MOISTURE DETECTION AND THE THERMAL RESISTANCE OF WET INSULATION.

Tobiasson, W., et al, Dec. 1978, 6p., ADA-063 144, 12 refs.

Korhonen, C.

33-2525

ROOFS, MOISTURE TRANSFER, DETECTION, INFRARED SPECTROSCOPY.

Nuclear, infrared, capacitance, microwave and impulse radar methods for nondestructively detecting moisture in roofs were evaluated. No system was reliable enough by itself or by cross-checking with another system to eliminate the need for a few core samples of membrane and insulation to verify findings. Airborne infrared surveys are a cost-effective way of reconnoitering numerous roofs at a major installation. However, follow-up on-the-roof surveys are necessary. Of the several *grid* techniques examined, nuclear *surveys were the most reliable. Hand-held infrared surveys* are the most accurate on-the-roof method studied. Although an infrared camera costs significantly more than a nuclear meter ($27,000 vs $3,000), infrared surveys can be conducted more rapidly. Where numerous roofs are to be surveyed, infrared surveys appear to be the most cost-effective method. *In-situ* measurements have been made of the thermal resistance of wet and dry portions of roofs. A laboratory apparatus has been built to subject 12 in x 12 in specimens of roof insulation to combined thermal and moisture gradients. Thermal resistance and moisture content are periodically *determined, and characteristic curves are being developed* for various roof insulations.

SR 78-30

GROWTH RATES AND CHARACTERISTICS OF ICE ON THE OTTAUQUECHEE AND WINOOSKI RIVERS OF VERMONT DURING WINTER 1977-78.

Deck, D.S., Dec. 1978, 30p., ADA-063 874.

34-1107

RIVER ICE, ICE GROWTH, ICE COVER THICKNESS, FRAZIL ICE.

Ice thickness, growth rates and characteristics of river ice are tabulated for use with a planned physical hydraulic model of the Ottauquechee River in Quechee, Vermont, using real ice.

SR 79-01

INFRARED THERMOGRAPHY OF BUILDINGS —A BIBLIOGRAPHY WITH ABSTRACTS.

Marshall, S.J., Feb. 1979, 67p., ADA-068 682.

33-3429

BIBLIOGRAPHIES, INFRARED RADIATION, BUILDINGS, HEAT LOSS, MOISTURE.

This report contains annotated abstracts of over 100 reports (66 more than the 1977 edition) on the new, but rapidly expanding subject of infrared thermography of buildings. The references cover remote sensing airborne surveys of large numbers of buildings, close-up ground surveys of individual buildings, and qualitative (speculative) and semi-quantitative (ground-truth) field surveys. The report presents examples of themographic energy audits, roof moisture surveys, building retrofit surveys, solar *panel* analysis, window assessments, and other practical applications by government agencies and private sector survey teams. It lists research and development efforts to provide fundamental information to improve quantification accuracy, evaluate equipment, and develop interpretation standards, along with examples of daily usage in contract specifications, public awareness programs, and product testing.

SR 79-02

LANDSAT DATA COLLECTION PLATFORM AT DEVIL CANYON SITE, UPPER SUSITNA BASIN, ALASKA—PERFORMANCE AND ANALYSIS OF DATA.

Haugen, R.K., et al, Feb. 1979, 17 refs., ADA-068 508, 7 refs.

Tuinstra, R.L., Slaughter, C.W.

33-3649

DATA TRANSMISSION, REMOTE SENSING, LANDSAT.

In October 1974, a Landsat Data Collection Platform was installed near the prospective Devil Canyon damsite on the Susitna River, south central Alaska. The development of sensor interfaces and characteristics of transmitted data for air and ground surface temperature, windspeed and wind run, water equivalent snow accumulation, and battery voltage are discussed. Temperature data are analyzed statistically and compared with data from surrounding National Weather Service stations. Although some difficulties were encountered in operation during the winter of 1974-75, it was demonstrated that the Landsat data collection system could provide useful environmental data from a remote, subarctic location in the winter on a near-real-time basis.

SR 79-03

COMMUNICATION IN THE WORK PLACE: AN ECOLOGICAL PERSPECTIVE.

Ledbetter, C.B., Feb. 1979, 19p., ADA-066 322, 30 refs.

33-2977

COLD WEATHER CONSTRUCTION, DATA TRANSMISSION, HUMAN FACTORS, ENVIRONMENTS.

Patterns of communication and social interaction within a work organization are significantly influenced by architecture. Nearly all work organizations are dependent upon information flow, both informal and formal, between coworkers. As a rule, the more open and informal the communication, the more productively and efficiently the organization operates. The architectural design concept of focal points is presented as a strategy for planning the work facility for improved informal communication. Examples of energy-efficient building design schemes for cold regions are presented. These prototype buildings combine design for improved worker efficiency with thermal efficiency.

SR 79-04

PRELIMINARY INVESTIGATIONS OF THE KINETICS OF NITROGEN TRANSFORMATION AND NITROSAMINE FORMATION IN LAND TREATMENT OF WASTEWATER.

Jacobson, S., et al, Mar. 1979, 59p., ADA-086 169, 94 refs.

Alexander, M.

34-3231

WASTE DISPOSAL, WATER TREATMENT, SOIL CHEMISTRY, LABORATORY TECHNIQUES.

In laboratory experiments, denitrification of nitrate in wastewater proceeded slowly in an acid soil (pH 4.2), but the rate was fast in soils with pH values of 5.5 to 6.8. The rate of denitrification was governed by the carbon source added, with glucose supporting the fastest rate. The rate was somewhat slower with methanol and succinate and was *appreciably slower* with secondary *effluents* as the source of supplemental carbon. Charlton loam supported the more rapid denitrification with glucose as a carbon source, but the rate was higher in Windsor sandy loam with sewage as the carbon source. Denitrification in these soils did not occur at 1C, and the rate increased with rising temperatures.

SR 79-05

PHYSICAL AND THERMAL DISTURBANCE AND PROTECTION OF PERMAFROST.

Brown, J., et al, Mar. 1979, 42p., ADA-069 405, Numerous refs.

Grave, N.A.

33-3830

PERMAFROST PRESERVATION, THERMAL STRESSES, HUMAN FACTORS, PERMAFROST DISTRIBUTION, DAMAGE.

This report is based on a review paper presented at the Third International Conference on Permafrost held in July 1978 at Edmonton, Canada. It reviews the literature covering 1974-1978 and covers subjects related to natural and human induced disturbance of terrain underlain by pprmafrost. Subjects include investigations undertaken in conjunction with oil and gas pipelines, terrain mapping, methods for estimating terrain sensitivity, methods of protecting terrain, and the thermal effects of off road transportation, oil spills, fire, removal of the surface soil layers, snow conditions, mining and other construction practieces. Methods of protecting and restoring permafrost in the USSR are presented in tabular form. An appendix summarizes results of modeling and microclimatic investigation, and the distribution and properties of subsea, land-based, and alpine permafrost.

SR 79-06

SPRAY APPLICATION OF WASTEWATER EFFLUENT IN WEST DOVER, VERMONT: AN INITIAL ASSESSMENT.

Cassell, E.A., et al, Apr. 1979, 38p., ADA-068 534, 26 refs.

Meals, D.W., Bouzoun, J.R.

33-3862

WASTE DISPOSAL, WATER TREATMENT, SOIL CHEMISTRY, WATER CHEMISTRY.

Runoff from spray application of secondary wastewater effluent on a forested hillside in West Dover, Vermont, was monitored for a six-week period (11 July-19 August 1977). Both quantity and quality of applied effluent and site drainage were monitored. On-site groundwater and two adjacent streams were sampled for water quality. Drainage flows were relatively constant during the study period in spite of highly variable inputs to the site. There is evidence that substantial quantities of water may be leaving the spray site by moving through the subsurface fragipan layer. On a mass basis, 95% of the total nitrogen, 96% of the ammonia nitrogen, 92% of the nitrate-nitrogen, 98% of the organic nitrogen, 99% of the total phosphorus, and 79% of the BOD5 were removed by spray application. Heavy precipitation was observed to flush most nutrient forms, especially nitrate-nitrogen, from the spray site. Groundwater on the spray field contained lower concentrations of nutrients than did the applied effluent, but higher concentrations than those found in site drainage. No hazardous nitrate levels were detected in groundwater. No elevations of nutrient concentrations in the Deerfield River on Ellis Brook were detected during the study period. However, there was some evidence of increased chloride concentrations in Ellis Brook.

SR 79-07

ENERGY REQUIREMENTS FOR SMALL FLOW WASTEWATER TREATMENT SYSTEMS.

Middlebrooks, E.J., et al, Apr. 1979, 82p., ADA-070 676, 16 refs.

Middlebrooks, C.H.

33-4225

WASTE DISPOSAL, WASTE TREATMENT, PONDS, SEEPAGE, SEEPAGE, COST ANALYSIS.

This report summarizes energy requirements for small wastewater treatment systems (0.05 - 5 million gallons per day) applicable to military installations. It compares various treatment combinations, and presents the energy requirements for the most viable alternatives in tabular form. It also presents energy requirements for various components of wastewater treatment systems in a format making it convenient to calculate the energy requirements for many combinations of the components. In addition, it summarizes briefly energy estimates made by others. The report compares typical combinations of unit operations and processes used to produce various quality effluents on the basis of energy consumption. It concludes that land application systems are the most energy-efficient wastewater treatment systems and that they are capable of producing an equivalent or higher quality effluent than any other treatment system.

SR 79-08

DESIGN PROCEDURES FOR UNDERGROUND HEAT SINK SYSTEMS.

Stubstad, J.M., et al, Apr. 1979, 186p. in var. pagns., ADA-068 926, 65 refs.

Quinn, W.F., Greenberg, M., Best, W.C., Botros, M.M.

33-3427

UNDERGROUND FACILITIES, HEAT TRANSFER, WASTE DISPOSAL, HEAT RECOVERY, HEAT SINKS.

This report presents criteria, engineering information and estimation procedures for the disposal of waste heat associated with the generation of power required to supply the needs of hardened defense underground installations. The major emphasis is placed on the temporary disposal of waste heat below ground while the installation is under attack and cannot rely upon aboveground disposal. A series of sample problems is included to illustrate the use of the estimation procedures presented in the report. All of the sample problems are based on the sizing of a heat sink system for an underground nuclear power plant. Under the design criteria which were assumed for the sample problems, it is shown that the combination ice/water type heat sink concepts provide the most cost effective solutions.

SR 79-09

ESTIMATED SNOW, ICE, AND RAIN LOAD PRIOR TO THE COLLAPSE OF THE HARTFORD CIVIC CENTER ARENA ROOF.

Redfield, R., et al, Apr. 1979, 32p., ADA-069 323, 19 refs.

Tobiasson, W., Colbeck, S.C.

33-4673

ROOFS, LOADS (FORCES), SNOW LOADS, ICE LOADS, RAIN.

The roof of the Hartford, Connecticut, Civic Center Arena collapsed under an unknown load of snow, ice and rain early in the morning on Jan. 18, 1978. Based on available meteorological and snow load measurements, estimates for the amount of load present at the time of failure are made using a number of techniques. In addition, previous maximum loads due to snow, ice or rain since the building was constructed are also estimated.

SR 79-10

RAPID DETECTION OF WATER SOURCES IN COLD REGIONS—A SELECTED BIBLIOGRAPHY OF POTENTIAL TECHNIQUES.

Smith, D.W., comp, May 1979, 75p., ADA-070 030.

Smith, G.A., comp, Brown, J.M., comp, Schraeder, R.L., comp, Kosikowski, L., comp.

33-4425

BIBLIOGRAPHIES, GROUND WATER, WATER SUPPLY, DETECTION, ELECTRICAL RESISTIVITY.

A review of current literature on existing techniques that could be utilized in the rapid location of water sources for field camp use in permafrost regions resulted in the selection of three non-ground contact methods of electrical resistivity and two radar methods as being the most effective techniques. The search included thousands of references; 77 of these were chosen to be included in the annotated bibliography. The interest level or pertinence of each entry to the study is indicated, and keywords are provided. The keyword index contains all keywords for all entries listed in alphabetical order.

SR 79-11

SEEKING LOW ICE ADHESION.

Sayward, J.M., Apr. 1979, 83p., ADA-071 040, 54 refs.

33-4226

ICE ADHESION, ADHESIVE STRENGTH, ICE PREVENTION, ICE SOLID INTERFACE, WETTABILITY, COHESION, POLYMERS, ICE REMOVAL, SURFACE PROPERTIES, SURFACE ENERGY.

Icing impairs operation of helicopters and other aircraft, antennae, power and communication lines, shipping and superstructures, canal locks, etc. Prevention or easier removal of icing requires reduction of its adhesion strength. Literature study shows that adhesion results from secondary (van der Waals) forces yet exceeds normal cohesive strengths. It depends on free surface energy, low contact angle, good contact and wetting, cleanliness, and texture. Modes of adhesion testing are briefly discussed. Poor adhesion occurs with low energy surfaces or contaminants, e.g. hydrocarbons, fluorocarbons, waxes, oils, etc., particularly when textured or porous. The resulting low contact angle, poor wetting and occlusion of air at the interface weaken the bond or provide stress loci which can initiate cracks and failure. Coefficient of expansion differences may help in release of ice. Further ideas appear among the 100 abstracts presented. A survey of over 300 manufacturers produced over 100 replies. Half of them offered some 100 products deemed worth testing. These are listed with addresses and contacts. Besides simple resins and other release agents, they include composites which combine low surface energy and stronger materials as micro-mixture, interpenetrating-network, "plastic-alloy," or filler-matrix systems. About 15 to 20 products appear of special interest. Samples of liquid coating or supplier-prepared panels of many are available for the testing phase to follow.

SR 79-12

FREEZING PROBLEMS ASSOCIATED WITH SPRAY IRRIGATION OF WASTEWATER DURING THE WINTER.

Bouzoun, J.R., May 1979, 12p., ADA-070 031, 5 refs.

34-136

WASTE TREATMENT, WATER TREATMENT, WASTE DISPOSAL, IRRIGATION, ICE PREVENTION.

During the winters of 1975-76, 1976-77 and 1977-78, biologically treated wastewater was applied to land in West Dover, Vermont. The wastewater was applied using the spray irrigation method at ambient temperatures as low as 0F. During the first winter, freezing was a major problem. Modified spray nozzles that were less susceptible to freezing were installed at both the low points and high points of the aboveground spray laterals. During the second and third winters, ice buildup along the spray laterals, particularly in the vicinity of the spray nozzles, caused serious damage to the pipes. Many man-hours were required to cut the ice repeatedly from the laterals. As an experiment to alleviate the problem, several 30- to 36-in risers were installed at an angle of approximately 30 degrees from the vertical on two of the spray laterals during the winter of 1977-78. They functioned well enough to warrant future installation on the entire system of spray laterals.

SR 79-13

PHOTOELASTIC INSTRUMENTATION—PRINCIPLES AND TECHNIQUES.

Roberts, A., et al, May 1979, 153p., ADA-072 011, 83 refs.

Hawkes, I.

33-4424

MEASURING INSTRUMENTS, OPTICAL PROPERTIES, STRESSES, ELASTIC PROPERTIES, INDICATING INSTRUMENTS, PHOTOELASTICITY.

This report contains a detailed review of the theory and design of photoelastic transducers for measuring loads, strains, stresses and pressures. The measurement of engineering parameters under the adverse conditions normally encountered in the mining and civil engineering industries presents great problems, particularly where such measurements are to be made over long periods of time. Photoelastic transducers have distinct advantages over competing equipment in this respect in that the parameters to be measured are revealed as light interference fringes, and the measuring gage itself often need consist of nothing more than simple steel and glass components. Examples of such gages are given in the report. The majority of the work reported here was carried out by the staff and students of the Postgraduate School of Mining, Sheffield University.

SR 79-14

ELECTROMAGNETIC GEOPHYSICAL SURVEY AT AN INTERIOR ALASKA PERMAFROST EXPOSURE.

Sellmann, P.V., et al, May 1979, 7p., ADA-071 065, 5 refs.

Delaney, A.J., Arcone, S.A.

33-4227

PERMAFROST PHYSICS, PERMAFROST STRUCTURE, GROUND ICE, ICE WEDGES, SOIL STRENGTH, ELECTROMAGNETIC PROSPECTING, GEOPHYSICAL SURVEYS, SEASONAL FREEZE THAW.

Road construction activity near Fairbanks, Alaska, in the late fall of 1977, revealed a large exposure of Fairbanks silt containing numerous massive ice features. These exposures are typical of those found in this region. Thaw, during the summer of 1978, caused the upper ice-rich sections to retreat several meters. Geophysical techniques were utilized over these exposures to determine if resistive anomalies of ice wedge dimension could be detected. Magnetic induction measurements at three intercoil spacings and low-frequency surface impedance measurements were made about 6 m from the edge of each exposure in April 1978 before thaw commenced. The results agree well with observations of the layering, but most individual anomalies are difficult to interpret because the lateral extent of the ice is unknown.

SR 79-15

IMPROVED DRAINAGE AND FROST ACTION CRITERIA FOR NEW JERSEY PAVEMENT DESIGN. PHASE 2 (DATA ANALYSIS).

Berg, R.L., May 1979, 51p., ADA-071 041, 7 refs.

33-4228

FROST PENETRATION, SUBSURFACE DRAINAGE, MOISTURE, FREEZING INDEXES, PAVEMENTS.

Before constructing actual highway pavements with open-graded drainage layers, frost penetration depths and moisture content profiles were measured beneath several pavements in New Jersey. Air and surface freezing indexes were measured at three locations during the 1975-1976 and 1976-1977 winters. All freezing indexes were considerably greater during the 1976-1977 winter. The modified Berggren equation was used to compute the maximum frost depth at 30 test sites. Measured maximum frost depths ranged from 20.5 in. to 52.0 in., while computed maximum values ranged from 14.0 in to 61.0 in. The mean difference between observed and computed maximum frost penetration depths was 3.8 in. Maximum frost penetration depths were computed for hypothetical pavements with open-graded drainage at four of the test sites. It was concluded that open-graded drainage layers would not significantly change the frost penetration beneath highway pavements in New Jersey. It was recommended that test pavements be installed to verify the computations.

SR 79-16

ROOF MOISTURE SURVEY—U.S. MILITARY ACADEMY.

Korhonen, C., et al, May 1979, 8 refs.

Tobiasson, W.

33-4229

ROOFS, WALLS, LEAKAGE, INSULATION, MOISTURE, INFRARED EQUIPMENT, MEASURING INSTRUMENTS.

The roofs and upper story walls of buildings 745E, 752, and 756 at the U.S. Military Academy, West Point, New York, were surveyed with a hand-held infrared camera to locate sources of reported wall leaks. An electrical resistance probe was used to determine the relative level of moisture in wall components. Several 3-in.-diam core samples of each roof were obtained to verify suspected moisture conditions and to examine the roof membrane in cross section. Wet areas on each roof were outlined with white spray paint. Wall leaks are believed to becaused by wind-driven rain entering the parapet walls in locations where the decorative glaze-coat has spalled off. Recommendations for maintenance of these buildings are based on information derived from the infrared survey, electric resistance readings, core samples and visual examinations.

SR 79-17

SMALL-SCALE TESTING OF SOILS FOR FROST ACTION AND WATER MIGRATION.

Sayward, J.M., May 1979, 17 p., ADA-071 989, 25 refs.

33-4435

SOIL TESTS, FROST ACTION, SOIL WATER MIGRATION, FROST HEAVE, ICE NEEDLES.

A method is described by which frost action (soil heaving and and needle ice) and the use of soil additives for its control can be studied. The apparatus and procedure are simple and convenient, requiring no extensive space or services and using only small quantities of materials. The procedure could be useful in developing a standard test for such purposes where small scale and convenience are requisite. Also described are two simple, small-scale accessory tests that likewise relate to permeability of soils. These evaporation and wetting tests might also have similar use, particularly in the study of water migration-inhibiting additives.

SR 79-18

EVALUATION OF NITRIFICATION INHIBITORS IN COLD REGIONS LAND TREATMENT OF WASTEWATER: PART 1. NITRAPYRIN.

Elgawhary, S.M., et al, May 1979, 25p., ADA-071 077, 21 refs.

Iskandar, I.K., Blake, B.J.

33-4230

WASTE TREATMENT, WATER TREATMENT, SOIL MICROBIOLOGY, LAND RECLAMATION, ARCTIC REGIONS.

A series of laboratory and field tests was conducted to investigate the possibility that nitrapyrin could be useful as a nitrification inhibitor in land treatment of wastewater. Laboratory tests included soil incubation and soil column studies. Variables were soil type, temperature, nitrapyrin concentration and method of application to the soil. Experimental designs included two soils, three temperatures (0, 10 and 20C) and three levels of inhibitors in a complete factorial. Forage grasses were present in all treatments, and wastewater containing NH4+ was utilized. Weekly application of wastewater was 5 cm. Soil solution at depth and leachate at 160 cm were collected and analyzed weekly for NH4N and NO3N. That data indicate that nitrapyrin was not effective in inhibiting nitrification when applied to the soil surface in soil columns simulating land treatment slow infiltration. The ineffectiveness of the compound under a mode of application where it is mixed and sprayed with wastewater is thought to be due to its volatility, sorption by organic matter, low water solubility and its immobility in soils. Other chemicals such as carbon disulfide and thiocarbonates, which have different characteristics than the nitrapyrin, showed promising results. Research is under way to obtain conclusive data.

SR 79-19

DRAINAGE NETWORK ANALYSIS OF A SUBARCTIC WATERSHED: CARIBOU-POKER CREEKS RESEARCH WATERSHED, INTERIOR ALASKA.

Bredthauer, S.R., et al, June 1979, 9p., ADA-073 595, 14 refs.

Hoch, D.

34-137

WATERSHEDS, DRAINAGE, SLOPE PROCESSES, PERMAFROST.

A Strahler stream order analysis and an exterior link length distribution analysis were made of the Caribou-Poker Creeks Research Watershed near Fairbanks Alaska. The drainage network map used for analysis was produced using a 1:2250 scale aerial photograph mosaic. Low drainage densities characterize the basins. Bifurcation ratios indicate that the overall drainage network is not dominated by strong geologic controls. Statistical analysis indicates that bifurcating source links and tributary source links do not belong to the same length population, a characteristic shared by watersheds in other climatic regions of the world. Additional analysis indicates that exterior links originating on permafrost slopes tend to be shorter than those originating on non-permafrost, well-drained slopes.

SR 79-20

INFRARED THERMOGRAPHY OF BUILDINGS: 1977 COAST GUARD SURVEY.

Marshall, S.J., June 1979, 40p., ADA-073 596, 9 refs.
34-138

BUILDINGS, HEAT LOSS, INFRARED PHOTOGRAPHY, WINDOWS.

An IRTB (infrared thermography of buildings) field survey, producing 631 thermograms, 127 photographs, and weather data, was conducted during a 14-day study of 10 Coast Guard stations in Maine, New Hampshire and Massachusetts. This report discusses how the survey was initiated and performed with emphasis on details for the benefit of the reader wishing to plan a survey. One hundred twenty selected thermograms and photographs in this report illustrate many types of heat loss and compare thermally ineffective doors and windows with units designated as standards for thermal effectiveness. Radiator heat leakage through walls, mottled moisture patterns on brick walls, infiltration patterns on glass, and poorly covered openings are illustrated. Thermograms of severe heat losses through glass doors, glass transoms, and glass wall panels are also included, and several solutions for individual heat loss problems, such as fiberglass garage doors and porcelain insulated panels, are suggested. Unanticipated survey problems, such as difficulties in obtaining photographs to compare with thermographically discovered artifacts and adjustments to survey techniques for inclement weather, are also discussed.

SR 79-21

ICEBERGS: AN OVERVIEW.

Kovacs, A., July 1979, 7p., ADA-078 692, 9 refs.
34-1597

ICEBERGS, CLASSIFICATIONS.

Icebergs are discussed and categorized according to their size, shape, composition and color. A general overview of iceberg-producing areas in the Arctic and Antarctic is given, and their drift and deterioration are discussed. (Auth.)

SR 79-22

DETERMINATION OF FROST PENETRATION BY SOIL RESISTIVITY MEASUREMENTS.

Atkins, R.T., July 1979, 24p., ADA-071 990.
33-4436

MEASURING INSTRUMENTS, FROST PENETRATION, ELECTRICAL RESISTIVITY, FROZEN GROUND PHYSICS.

Two sensors that depend on changes in soil resistivity were tested. Tests were conducted under a parking area with an asphalt-concrete surface where salt was periodically applied as part of snow removal operations. For comparison, data were obtained from a resistivity probe, a thermocouple probe and a thermistor probe. Results indicated that measuring temperature to determine frost penetration can lead to large errors under some conditions, for instance when salt has been applied or when frost is coming out of the ground in spring. The resistivity probe performed reliably during the entire measurement program. It was concluded that resistivity probes have definite advantages which should be considered when future frost penetration measurement programs are designed.

SR 79-23

DOCUMENTATION OF SOIL CHARACTERISTICS AND CLIMATOLOGY DURING FIVE YEARS OF WASTEWATER APPLICATION TO CRREL TEST CELLS.

Iskandar, I.K., et al, July 1979, 82p., ADA-074 712, 14 refs.

Quarry, S.T., Bates, R.E., Ingersoll, J.
34-743

WASTE DISPOSAL, WATER TREATMENT, SOIL CHEMISTRY, CLIMATOLOGY, METEOROLOGICAL DATA.

Section 1 deals with physical properties of the two soils used and the changes in soil chemical characteristics. The physical properties of the soil are those most important in controlling the rate of water movement in soils, such as saturated and unsaturated soil hydraulic conductivity, particle size distribution, bulk density, void ratio, available water and specific gravity. The chemical characteristics of the soil that are of potential importance in assessing the short and long-term effects of wastewater application on land include: free iron oxides, organic carbon, organic nitrogen, pH, conductivity, cation exchange capacity, exchangeable cations, total and extractable phosphorus, and total and extractable heavy metals. Section 2 summarizes climatic conditions at the CRREL site in Hanover, New Hampshire, and the changes that occurred during the period 1974 to 1978. Climatic parameters include temperature, precipitation, wind speed, and soil temperature at depth.

SR 79-24

DETERMINATION OF DISSOLVED NITROGEN AND OXYGEN IN WATER BY HEADSPACE GAS CHROMATOGRAPHY.

Leggett, D.C., July 1979, 5p., ADA-074 411, 25 refs.
34-744

LAKE WATER, WATER CHEMISTRY.

In this study dissolved oxygen and nitrogen were determined by shaking 20 to 25 ml of water with an equal amount of helium in a 50-ml gas-tight syringe and injecting 2 ml of the equilibrated headgas into a gas chromatograph. Oxygen and nitrogen were separated on a 5-A molecular sieve column at ambient temperature and detected with a hot wire detector, using atmospheric air for calibration. Advantages of this method over previously reported methods are 1) oxygen and nitrogen are determined in a single analysis, 2) no specifically fabricated stripping apparatus is needed, and 3) analysis can be done in the field with completely portable, battery-operated equipment. The method appears to be accurate and reproducible; several lake O2 and N2 profiles were obtained using this technique.

SR 79-25

BULLET PENETRATION IN SNOW.

Cole, D.M., et al, July 1979, 23p., ADA-074 412, 14 refs.

Farrell, D.R.
34-626

SNOW (CONSTRUCTION MATERIAL), PROJECTILE PENETRATION, PENETRATION TESTS.

Three types of ammunition, the M193, M80, and M43, were tested. Rounds were fired into snow targets of various thicknesses up to that thickness required to fully stop the projectiles. The maximum penetrations for the three rounds tested were 0.70 m, 1.26 m and 1.06 m, respectively. Velocity loss as a function of target thickness was determined by measuring projectile velocity before and after impact of the projectile with the target. The velocity loss vs. thickness data showed a sigmoid shape common to the three types of rounds. The impact and exit yaw angles of the M193 rounds were estimated. Scatter in the test data was attributed, in part, to random variations in the impact yaw angle. The penetration required for a 90 deg yaw was determined by the exit yaw measurements. This was shown to correspond to the inflection point on the velocity loss vs. penetration curve. This point is potentially significant in the design of composite fortifications. Discussions deal with basic concepts and definitions, the occurrence and significance of projectile tumbling and the use of laboratory tests for small arms evaluation in snow targets. The validity of the methodology used was established by testing M193 rounds in gelatin targets. These results compared favorably with similar test results in literature.

SR 79-26

APPLICATION OF HEAT PIPES ON THE TRANS-ALASKA PIPELINE.

Heuer, C.E., July 1979, 27p., ADA-073 597, 26 refs.
34-139

PIPELINES, HEAT PIPES, HEAT TRANSFER.

The application of heat pipes on the Trans-Alaska Pipeline is reviewed. The subjects addressed include the general functioning of a heat pipe, the specific heat pipe design used, the different situations where heat pipes were employed, the methods used to develop the heat pipe design, the methods used to monitor the operating heat pipes, and the performance of the heat pipes. The discussion is qualitative in nature. Quantitative information is largely omitted to allow coverage of a broad area and because it may be considered proprietary. Nevertheless, the information presented here should give a good appreciation of the quality and complexity of the heat pipe design. The information should also be useful in developing heat pipes for use in other cold regions applications.

SR 79-27

EXTENDING THE USEFUL LIFE OF DYE-2 TO 1986, PART 1: PRELIMINARY FINDINGS AND RECOMMENDATIONS.

Tobiasson, W., et al, July 1979, 15p., ADA-074 733, 3 refs.

Korhonen, C., Redfield, R.
34-745

COLD WEATHER CONSTRUCTION, ICE SHEETS, STEEL STRUCTURES, STRESSES.

DEW Line Ice Cap Station DYE-2 appears to need major work within the next few years to extend its useful life to 1986. The structural steel frame is overstressed in a few areas, and the lower portion of the subsurface timber truss enclosure is in bad condition. Additional performance measurements are needed during 1979 to determine the rate of secondary stress in the structural steel frame and the rate of deterioration of the truss enclosure. With this information, a decision can be made whether to move the building sideways onto a new undistorted foundation or to stabilize it in-place by encapsulating the lower 52 ft of the substructure in ice.

SR 79-28

UTILIZATION OF SEWAGE SLUDGE FOR TERRAIN STABILIZATION IN COLD REGIONS, PART 2.

Gaskin, D.A., et al, Aug. 1979, 36p., ADA-074 725, 10 refs. For Part 1 see 32-1368.

Palazzo, A.J., Rindge, S.D., Bates, R.E., Stanley, L.E.
34-746

SLUDGES, SEWAGE DISPOSAL, SOIL STABILIZATION, VEGETATION.

From June 1975 to Sep. 1976, a research/demonstration study was conducted at CRREL in Hanover, New Hampshire, to investigate the use of sewage sludge, commercial fertilizer and cultivation techniques for terrain stabilization in cold regions. Twenty-seven test plots on a 16-deg west-facing slope received various combinations of: 1) surface preparation (tilling, bulldozer tracking, or compacting), 2) nutrient source (sewage sludge or fertilizer), 3) mulching agent (wood fiber mulch or peat moss), and 4) tacking agent (Terra Tack III or Curasol). The plots were seeded in either the spring or fall with a constant seed mixture. The effectiveness of the treatments was determined through vegetation yields and soil loss measurements.

SR 79-29

MASS WATER BALANCE DURING SPRAY IRRIGATION WITH WASTEWATER AT DEER CREEK LAKE LAND TREATMENT SITE.

Abele, G., et al, Aug. 1979, 43p., ADA-080 649, 3 refs.

McKim, H.L., Brockett, B.E.
34-2284

WATER TREATMENT, WASTE TREATMENT, WATER BALANCE, SEWAGE TREATMENT, IRRIGATION.

The water budget for a 3.6-ha test area was calculated during and two days after a 2.7-cm (equivalent to 991,000 l) application of wastewater. By computing the water remaining in the soil from soil sample water content data, calculating the amount lost to evapotranspiration and measuring the underdrain flow rate, it was possible to calculate the water budget to within 95% of the actual amount applied. The accuracy in computing the soil water content is critical. In this case, a 1% variation of error in the volumetric water content is equivalent to nearly one third of the total water applied.

SR 79-30

TUNDRA LAKES AS A SOURCE OF FRESH WATER: KIPNUK, ALASKA.

Bredthauer, S.R., et al, Sep. 1979, 16p., ADA-075 475, 12 refs.

Doerflinger, D.F.
34-740

LAKE WATER, TUNDRA, SNOWMELT, WATER SUPPLY, ARCTIC REGIONS.

A study of water quality in several small tundra lakes near Kipnuk, Alaska, was conducted to determine if the lakes were of sufficiently high quality during the snowmelt season to provide the village with enough water for a year-round supply. Since the village is located just 4 miles inland from the Bering Sea, primary emphasis was placed on locating water sources with low chloride concentrations. The tundra lakes were of sufficiently high quality to be pumped into a storage area during early summer to be used as a year-round supply.

SR 79-31

USE OF 15N TO STUDY NITROGEN TRANSFORMATIONS IN LAND TREATMENT.

Jenkins, T.F., et al, Sep. 1979, 32p., ADA-077 583.

Quarry, S.T., Iskandar, I.K., Edwards, A.P., Hare, H.E.
34-2364

WASTE DISPOSAL, WATER TREATMENT, IRRIGATION, SOIL CHEMISTRY.

The objective of this study was to compare different strategies of using 15N as a tracer to describe the fate of wastewater N in land application of wastewater. Four soil columns were packed with Windsor sandy loam soil and covered with forage grass. The columns were treated with 7.5 cm of either tapwater or wastewater according to four experimental strategies. The strategies varied the treatment given the soil prior to application of the 15N label, the schedule and amounts of the applied 15N label, and the type of water used for subsequent column leaching. Soil solution at depth and leachate were analyzed weekly for concentration and 15N content of nitrate and ammonium. Plant samples were obtained periodically throughout the experiment and, together with soil samples collected at the end of the experiment, analyzed for total nitrogen content and 15N/14N ratios.

SR 79-32

BACTERIAL AEROSOLS FROM A FIELD SOURCE DURING MULTIPLE-SPRINKLER IRRIGATION: DEER CREEK LAKE STATE PARK, OHIO.

Bausum, H.T., et al, Sep. 1979, 64p., ADA-077 632, 18 refs.

Bates, R.E., McKim, H.L., Schumacher, P.W., Brockett, B.E., Schaub, S.A.
34-1381

WATER TREATMENT, WASTE DISPOSAL, IRRIGATION, AEROSOLS, MICROBIOLOGY.

An evaluation of microbiological aerosols resulting from the spray irrigation of wastewater under known atmospheric stability conditions was performed during July and August 1978 at the Deer Creek Lake land treatment system in Ohio. In the experiment, ponded chlorinated wastewater was sprayed onto a 6-acre test area with 96 impact sprinklers representing a multi-source field aerosol distribution system. Approximately 99.9% of the wastewater applied to the 23-hectare test area fell within the area of influence of the sprinkler (about a 20-m diam circle around the sprinkler riser) with only 0.10% of the applied wastewater aerosolized. Indigenous total aerobic bacteria in the wastewater and resultant aerosols were sampled and analyzed. Fluorescent dye studies were also performed to characterize the aerosol cloud without the effects of biological decay. During all of the aerosol tests continuous on-site meteorological measurements were made and wastewater chemical parameters monitored.

SR 79-33

TEST OF SNOW FORTIFICATIONS.

Farrell, D.R., Oct. 1979, 15p., ADA-078 742, 16 refs.

34-1598

PENETRATION TESTS, MILITARY ENGINEERING, SNOW (CONSTRUCTION MATERIAL), FORTIFICATIONS, SMALL ARMS AMMUNITION.

A field study was conducted to 1) more accurately define the degree of protection offered by simple snow fortification and 2) evaluate the effort required by infantry troops to build such fortifications when only basic tools are available. A seven-man infantry squad, equipped with standard issue snow shovels and an arctic sled (Akhio), constructed several simple snow structures. Construction was made more difficult by the imposition of a camouflage discipline requirement. When completed, three positions were subjected to M16A1 rifle fire while the infantry squad executed a simulated tactical assault. A fourth and much larger position was tested with simulated covering fire from a M2HB 50-caliber machine gun. None of the 5.56-mm bullets fired by the squad from ranges of 200 m to as close as 10 m managed to penetrate the 1.8-m-thick snow embankments. The 12.7-mm-diameter bullets fired from the M2HB at a range of 250 m were all stopped by 3.0 m of packed snow. The camouflage considerations and the shallow snow conditions increased the construction time for the three small emplacements by almost a factor of four, and for the larger emplacement by almost a factor of three. But the squad still handled a volume of packed snow that was equal to 3.7 times the volume of unfrozen soil that could be handled with the same amount of effort, according to field manual estimates. Under frozen soil conditions the advantages of using snow would be *significantly* greater.

SR 79-34

UTILIZATION OF SEWAGE SLUDGE FOR TERRAIN STABILIZATION IN COLD REGIONS. PT. 3.

Rindge, S.D., et al, Oct. 1979, 33p., ADA-077 585.

Gaskin, D.A., Palazzo, A.J.

34-2365

WASTE DISPOSAL, SEWAGE DISPOSAL, SOIL STABILIZATION.

The authors have conducted a two-year revegetation study to assess the ability of sewage sludge applications with or without supplemental fertilizer to promote plant growth and stabilize sloping soils. The study site was a west-facing, 16 deg slope at CRREL in Hanover, New Hampshire. Eight revegetation treatments and one control were replicated three times. Treatments involved applications of dewatered, anaerobically digested sewage sludge at two rates (20 or 40 tons/acre). The sludge was applied alone or in combination with commercial fertilizers which supplied nitrogen, phosphorus and potassium, or all three nutrients. The seed mixture in the treatments contained four grasses and one legume. The effects of the various treatments were determined through soil loss yields, visual grass ratings and plant yields.

SR 79-35

PROTOTYPE OVERLAND FLOW TEST DATA: JUNE 1977-MAY 1978.

Jenkins, T.F., et al, Nov. 1979, 91p., ADA-078 743, 9 refs.

34-1599

WASTE TREATMENT, WATER TREATMENT, IRRIGATION, SOIL CHEMISTRY, ION EXCHANGE, METEOROLOGICAL DATA.

A prototype overland flow land treatment system was operated at Hanover, New Hampshire, over a one-year cycle from June 1977 to May 1978. The individual data points collected over this period for water quantity and quality are presented, as well as plant yields and nutrient uptake. The soil chemical and physical parameters measured are also presented along with a table of initial site characteristics. The meteorological measurements obtained in support of this effort are included to complete the data base.

SR 79-36

PROCEEDINGS OF A MEETING ON MODELING OF SNOW COVER RUNOFF, 26-28 SEPTEMBER 1978, HANOVER, NEW HAMPSHIRE.

Colbeck, S.C., ed, Jan 1979, 432p., ADA-167 767, For individual papers see 34-1002 through 34-1040. Numerous refs.

Ray, M., ed.

34-1001

MEETINGS, SNOW COVER, RUNOFF, MODELS.

SR 80-01

DISINFECTION OF WASTEWATER BY MICROWAVES.

Iskandar, I.K., et al, Jan. 1980, 15p., ADA-082 174, 36 refs.

Parker, L.V., Madore, K., Gray, C., Kumai, M.

35-2592

WASTE TREATMENT, WATER TREATMENT, MICROWAVES, BACTERIA.

Results from a laboratory study show that microwave energy can be used for disinfection of wastewater. The time required for destruction of bacteria by microwaves was reduced over that of conventional heating. Destruction of wastewater bacteria and a cell-suspension of of *E. Coli* B. was logarithmic after an initial lag phase, which was dependent upon the volume used. Thermophilic *B. stearothermophilus* cells were used to try to determine if the mechanism of destruction was thermal.

SR 80-02

ICEBREAKING CONCEPTS.

Mellor, M., Jan. 1980, 18p., ADA-082 175, 4 refs.

35-2593

ICE BREAKING, ICEBREAKERS, ICE COVER THICKNESS, PENETRATION, ICE CUTTING, ICE BLASTING, MARINE TRANSPORTATION, OFFSHORE STRUCTURES.

Icebreaking concepts that have potential application in the protection of offshore stuctures and drillships are reviewed. The concepts dealt with include conventional icebreaking by ships, icebreaking by air cushion vehicles, breaking against fixed structures, mechanical cutting with drag bit tools, blasting by high explosives, blasting with compressed gases or propellants, ice melting, thermal cutting, cutting with lasers, cutting with high pressure water jets, and unproven novel concepts. Special emphasis is given to the specific energy requirements for the various methods.

SR 80-03

DANISH DEEP DRILL; PROGRESS REPORT: FEBRUARY-MARCH 1979.

Rand, J.H., Jan. 1980, 37p., ADA-082 206.

35-2594

DRILLING, ICE CORING DRILLS, ICE CORES, GLACIOLOGY, DESIGN, PERFORMANCE, MAINTENANCE.

The "Danish Deep Drill" was developed at the University of Copenhagen. The drill, which will be used to obtain ice cores from the Greenland Ice Sheet, was tested at the U.S. Army Cold Regions Research and Engineering Laboratory. The drill is battery-operated and has a down-hole microprocessor-based control section and a delicately balanced chip removal system. It is a lightweight, electro-mechanical drill designed to obtain a 10.2-cm-diameter core in 2-m lengths. There are potential problems in chip recovery and storage, malfunctions of the computer or batteries, leaks in the pressure chamber, spin-out or rotation of the drill, and the very close tolerances required by the drill design. Tests are recommended that will help eliminate some of these potential problems and determine the drill's overall strengths and weaknesses. The drill is a very complex and delicate instrument that will require constant maintenance, modification and monitoring when in use.

SR 80-04

EVALUATION OF ICE DEFLECTORS ON THE USCG ICEBREAKER POLAR STAR.

Vance, G.P., Jan. 1980, 37p., ADA-082 205.

35-2595

ICEBREAKERS, PROPELLERS, ICE COVER THICKNESS, ICE NAVIGATION.

Model tests were carried out in the CRREL Ice Engineering Facility test basin on a 1-to-19.1 model of the USCG *Polar Star* (WAGB-10) to determine the effectiveness of several different devices that would eliminate or mitigate the ingestion of ice into the propeller slip stream. Propeller RPM records and highspeed movies were obtained for each device in two thicknesses of ice and at two speeds. Four devices were evaluated: large bilge keels, small bilge keels, bossing fins and propeller cages (called bird cages). The most effective concept appeared to be the bilge keels. Open water power tests and structural analysis must now be carried out to determine the overall feasibility of these concepts.

SR 80-05

COASTAL ENVIRONMENT, BATHYMETRY, AND PHYSICAL OCEANOGRAPHY ALONG THE BEAUFORT, CHUKCHI AND BERING SEAS.

Gatto, L.W., Jan. 1980, 357p., ADA-084 281, 56 refs.

34-3328

COASTAL TOPOGRAPHIC FEATURES, BATHYMETRY, MARINE GEOLOGY, SHORELINE MODIFICATION, OCEANOGRAPHY, ENVIRONMENTS.

The report compiles references, figures, and tables that are concerned with the coastal environment, bathymetry, and physical oceanography along the Beaufort, Chukchi, and Bering Seas. The text, intentionally minimized, describes the salient points with a minimum of detail. The extensive references and figures give direction to a reader seeking additional information.

SR 80-06

POST OCCUPANCY EVALUATION OF A PLANNED COMMUNITY IN ARCTIC CANADA.

Bechtel, R.B., et al, Feb. 1980, 27p., ADA-082 162, 4 refs.

Ledbetter, C.B.

35-2596

URBAN PLANNING, HOUSES, SITE SURVEYS, BUILDINGS, ECOLOGY.

This report describes a post-occupancy evaluation of a small mining community in the high Arctic. Providing superior housing, having wives work and integrating singles, Inuits (the indigenous people) and families successfully established a viable community. Fewer problems were encountered than is usual in other isolated cold regions communities. The central focal point of the town, a large dome, was diluted by later construction of buildings housing separate recreational and social facilities. Since the buildings are too costly to remove, the only method of restoring the focal point is to build connecting links at upper levels of the recreational buildings.

SR 80-07

SOME ASPECTS OF SOVIET TRENCHING MACHINES.

Mellor, M., Feb. 1980, 13p., ADA-082 176, 1 ref.

35-2597

TRENCHING, FROZEN GROUND, EARTHWORK, EQUIPMENT, DESIGN.

Technical characteristics of Soviet trenching machines are assessed and compared with those of similar machines built in the United States and Europe. The report deals with transverse rotation machines and belt machines, considering rotor speeds and belt speeds, tool speeds, power/weight ratios, power density, traverse speeds, and effective mean cutting pressures. The probable capabilities of Soviet machines for cutting frozen ground are assessed. It is concluded that, while general design characteristics are satisfactory, construction and product development are weak, and performance in frozen ground is not expected to be impressive.

SR 80-08

DOCUMENTATION FOR A TWO-LEVEL DYNAMIC THERMODYNAMIC SEA ICE MODEL.

Hibler, W.D., III, Feb. 1980, 35p., ADA-084 273, 9 refs.

34-3329

SEA ICE, ICE THERMAL PROPERTIES, THERMODYNAMIC PROPERTIES, HEAT TRANSFER, ICE MECHANICS, ICE COVER THICKNESS, MATHEMATICAL MODELS, COMPUTER PROGRAMS, RHEOLOGY.

A discussion of the numerics and computer code for a two-level dynamic thermodynamic sea ice model is presented. For interested users a listing of the computer code and results from a 21-day test run are included as appendices. To a large degree this report is meant to serve as an extended appendix to an article by the author in the Journal of Physical Oceanography (see 34-741) describing his model and a variety of simulation results. The model consists of a two-level ice thickness distribution coupled to the ice dynamics by a plastic rheology. In addition to the ice interaction, the momentum balance includes nonlinear wind and water drag terms, Coriolis force, and inertial and momentum advection terms. The numerical scheme is formulated in an energy-conserving manner in a fixed Eulerian grid which allows simulation over unlimited time intervals. The momentum balance (including inertial terms) is numerically treated in a semi-implicit manner so that time steps of up to one day in length may be used if desired. The boundaries, grid size and time step magnitude are easily modified so that the model should have application to a variety of climate and forecasting problems.

SR 80-09

ICE THICKNESS-TENSILE STRESS RELATIONSHIP FOR LOAD-BEARING ICE.

Johnson, P.R., Feb. 1980, 11p., ADA-084 274, 3 refs.

34-3330

ICE COVER STRENGTH, ICE LOADS, ICE CROSSINGS, ICE ROADS, TENSILE PROPERTIES, STRESSES, ICE COVER THICKNESS.

The "bearing capacity" of a floating ice sheet is of considerable interest. The pattern of ice thickness vs tensile stress for a fixed load and fixed ice properties was examined and showed some constant relationships. It proved possible to completely describe the ice thickness-tensile stress pattern in terms of a single number. When the load was changed by increasing the payload but not altering the geometry of the load pattern, other relationships were found that described the tensile stress in the ice sheet for any combination of payload and ice thickness. This provides a simple method of finding tensile stress in the ice that can be used in the field. Further studies are planned.

SR 80-10

OPERATION OF THE CRREL PROTOTYPE AIR TRANSPORTABLE SHELTER.

Flanders, S.N., Feb. 1980, 73p., ADA-084 275.

34-3331

PORTABLE SHELTERS, COLD WEATHER PERFORMANCE, TRANSPORTATION, AIRPLANES, LOGISTICS.

This report describes the operation of the CRREL prototype air-transportable shelter which was designed specifically for use in cold regions. The operating instructions cover moving the shelter on its own wheels or skis, loading it onto a truck or military transport aircraft, slinging it from a helicopter or preparing it for shipment as an ISO container. The report details how to site the shelter and expand it to about double its transport size. The report also covers operation of the utility systems, including the on-board alternator set, the primary and auxiliary heating systems, the water system, and various safety systems.

SR 80-11

SNOW FORTIFICATIONS AS PROTECTION AGAINST SHAPED CHARGE ANTITANK PROJECTILES.

Farrell, D.R., Mar. 1980, 19p., ADA-084 276.

34-3332

SNOW STRENGTH, FORTIFICATIONS, COLD WEATHER CONSTRUCTION, COLD WEATHER OPERATION, SNOW (CONSTRUCTION MATERIAL), EXPLOSION EFFECTS, IMPACT TESTS, DETONATION WAVES, EMBANKMENTS.

This report chronicles an investigation of the effectiveness of snow fortifications. The test was planned to observe and measure how packed snow absorbs the energy of high explosive antitank (HEAT) ammunition. In the test plan both the possibility of non-detonation due to insufficient resistance in snow and the rate of deterioration of a snow embankment with repeated impacts were considered. The 90-mm M67 recoilless rifle was used because it has a relatively low velocity, and its charge was more likely to not detonate than that of a high velocity weapon. The findings indicate that snow can be used to good advantage for building expedient fortifications, particularly in situations where large volumes of snow have to be cleared from roads and airfields.

SR 80-12

DRILLING AND CORING OF FROZEN GROUND IN NORTHERN ALASKA, SPRING 1979.

Lawson, D.E., et al, Mar. 1980, 14p., ADA-084 277, 6 refs.

Brockett, B.E.

34-3333

DRILLING, PERMAFROST STRUCTURE, STRATIGRAPHY, GROUND ICE, PERMAFROST SAMPLERS, CORE SAMPLERS, EQUIPMENT.

Frozen samples of perennially frozen ground were obtained from 33 holes drilled at six locations in the National Petroleum Reserve, Alaska, in the spring of 1979. Total depth of drilling was 510 m (1670 ft), of which 178 m (584 ft) was cored. The objectives of the program were to define the location and extent of segregated and massive ice at each location and to determine the origins and ages of the ground ice through studies of the hole stratigraphy and future laboratory analyses of core samples.

SR 80-13

EXTENDING THE USEFUL LIFE OF DYE-2 TO 1986. PART 2: 1979 FINDINGS AND FINAL RECOMMENDATIONS.

Tobiasson, W., et al, Apr. 1980, 37p., ADA-084 278, 8 refs.

Tilton, P.

34-3334

RADAR, STATIONS, SNOW ACCUMULATION, ICE FORMATION, SNOW STRENGTH, LOADS (FORCES), STEEL STRUCTURES, STRESSES, COST ANALYSIS.

A major construction effort is needed at Dew Line Ice Cap Station DYE-2 to extend its useful life to 1986. That work should be done as soon as possible because the truss enclosure is deteriorating rapidly. Although a 210-ft sideways move as was accomplished at DYE-3 in 1977 is technically feasible, the alternative of backfilling the truss enclosure with ice is expected to cost about $2.7 million less. Unless there is a strong possibility that DYE-2 will be needed for many years beyond 1986, the ice backfill alternative is recommended.

SR 80-14

CRREL ROOF MOISTURE SURVEY, PEASE AFB BUILDINGS 35, 63, 93, 112, 113, 120 AND 220.

Korhonen, C., et al, Mar. 1980, 31p., ADA-084 279, 3 refs.

Tobiasson, W.

34-3335

ROOFS, MOISTURE TRANSFER, DETECTION, INFRARED SPECTROSCOPY, THERMAL INSULATION, MEASURING INSTRUMENTS.

We surveyed the roofs of seven buildings at Pease AFB with a hand-held infrared scanner to detect wet insulation. We used white spray paint to outline the wet areas and took core samples of the built-up membrane and insulation to verify our findings. Flashing defects around penetrations and bordering walls appear to be the major cause of the wet insulation found on these roofs. Since most problem areas are localized, we directed our repair recommendations toward salvaging as much of each roof as is economically possible.

SR 80-15

REGIONAL DISTRIBUTION AND CHARACTERISTICS OF BOTTOM SEDIMENTS IN ARCTIC COASTAL WATERS OF ALASKA.

Sellmann, P.V., Apr. 1980, 50p., ADA-084 922, Refs. p.31-50.

35-2598

SUBSEA PERMAFROST, PERMAFROST DISTRIBUTION, BOTTOM SEDIMENT, MARINE *GEOLOGY, SEDIMENT TRANSPORT*, PERMAFROST DEPTH, ICE SCORING, OFFSHORE STRUCTURES, ARTIFICIAL ISLANDS, CONSTRUCTION MATERIALS, OFFSHORE DRILLING.

This report includes a discussion of some of the properties *and characteristics of offshore marine sediments found in* the U.S. Beaufort Sea that could influence aspects of offshore development. A collection of references is also included in an appendix. Perennially and seasonally frozen sediments are extremely common, with variable distribution and properties. The depth to the top of icebonded permafrost can be as little as 7 m below the seabed many kilometers from the sea coast. The subsea permafrost can contain visible ground ice similar to that observed on land, and can be anticipated to cause problems at least as great as those experienced on land.

SR 80-16

NITROGEN TRANSFORMATIONS IN A SIMULATED OVERLAND FLOW WASTEWATER TREATMENT SYSTEM.

Chen, R.L., et al, Apr. 1980, 33p., ADA-084 280, 36 refs.

Patrick, W.H., Jr.

34-3365

WASTE TREATMENT, WATER TREATMENT, NUTRIENT CYCLE, SOIL CHEMISTRY.

Treating wastewater in properly designed and operated overland flow systems results in significant amounts of N being removed through nitrification-denitrification reactions. Application of wastewater containing NH4-N in a simulated overland flow model led to the disappearance of ammonium and the formation of nitrate in oxidized surface soil. The N balance in the simulated overland flow system was estimated by using labeled 15 N. The amount of N removed in the system depends upon denitrification rates. The results of this study indicated that N adsorption on the soil complex and uptake of applied ammonium by vegetation accounted for the N removed in the overland flow systems. The adsorbed ammonium on the aerated surface soil mass was *nitrified and converted to oxidized forms of N. The* nitrate thus formed diffused downward to the reduced zone during subsequent wastewater applications. Some of this nitrate then denitrified and converted to gaseous form of N or was assimilated and reduced by plant life. Results of the overland flow studies indicated that approximately 55-68% of wastewater NH4-N added to the simulated overland flow system was unaccounted for in controlled laboratory environments. This NH4-N was presumably returned to the atmosphere.

SR 80-17

INFLUENCE OF NOSE SHAPE AND L/D RATIO ON PROJECTILE PENETRATION IN FROZEN SOIL.

Richmond, P.W., Apr. 1980, 21p., ADA-085 398, 10 refs.

34-3450

FROZEN GROUND, PROJECTILE PENETRATION, SOLUTIONS, EXPERIMENTATION.

This report presents the results of a laboratory test program designed to determine the applicability of two analytical solutions to projectile penetrations in frozen soils. The test program consisted of firing small caliber cylindrical projectiles into frozen soil targets. Four types of 7.9-mm-diam projectiles were tested: two with a hemispherical nose the other two flat-nosed, with both long (length/diameter = + 4) and short (L/D = 2) versions of each nose shape. Penetration depth versus impact velocity data are presented. Comparisons of the data indicate that a flat-nosed projectile is a less efficient penetrator than one of equal weight with a hemispherical nose. A small increase in resistance to penetration is observed for an increased L/D ratio.

SR 80-18

DEICING A SATELLITE COMMUNICATION ANTENNA.

Hanamoto, B., et al, Apr. 1980, 14p., ADA-085 397.

Gagnon, J.J., Pratt, B.

34-3451

ICE PREVENTION, ANTENNAS, SPACECRAFT, PROTECTIVE COATINGS, HEATING, THERMAL EFFECTS, POLYMERS.

Ice buildup on communication antenna dishes begins to cause signal reception problems when the thickness exceeds 0.64 cm (0.25 in.). CRREL's copolymer coating, which reduces the adhesive force between ice and the coated surface, was tested on antenna dish panels to facilitate ice removal. A combination of the copolymer coating and heat proved to be an effective method of removing ice from the panel.

SR 80-19

WINTER ENVIRONMENTAL DATA SURVEY OF THE DRAINAGE BASIN OF THE UPPER SUSITNA RIVER, ALASKA.

Bilello, M.A., Apr. 1980, 30p., ADA-086 931, 6 refs.

34-2725

CLIMATE, ICE COVER, SNOW COVER, *METEOROLOGICAL DATA, WINTER*, UNITED STATES—ALASKA—SUSITNA RIVER.

Basic data on the winter climate and measurements on all available snow and ice cover conditions were compiled for an area in and around the upper Susitna River basin of Alaska. The 10 years of tabulated data (from Sep. 1964 to May 1974) for 16 locations include average monthly values of air temperature, precipitation amounts (including total snowfall) and maximum depth of snow on the ground. Ice thickness measurements and other related winter surface conditions on rivers in the basin are included in the report. Detailed observations on physical properties of the snow cover and the rate at which soil thaws in the spring are also provided for selected stations near the area under study.

SR 80-20

SEDIMENT DISPLACEMENT IN THE OTTAUQUECHEE RIVER—1975-1978.

Martinson, C.R., May 1980, 14p., ADA-089 787, 3 refs.

35-974

SEDIMENT TRANSPORT, BOTTOM SEDIMENT, ICE SCORING, ICE EROSION, BANKS (WATERWAYS), RIVER ICE, HYDROLOGY.

A three-year study of sediment displacement was conducted on a short section of the Ottauquechee River in Vermont that has erosional problems caused by ice. The results of cross-sectional surveys showed large quantities of the bank eroded and deposition in the bed within the study area. The erosion appears to have been caused by 1) the ice scouring the banks and 2) ice plugging the channel and diverting the flow toward the banks.

SR 80-21

CONSTRUCTION OF AN EMBANKMENT WITH FROZEN SOIL.

Botz, *J.J., et al, May 1980, 105p., ADA-086 877, 44* refs.

Haas, W.M.

34-3873

EMBANKMENTS, FROZEN GROUND STRENGTH, COLD WEATHER CONSTRUCTION, SOIL COMPACTION, SETTLEMENT (STRUCTURAL), FROST PENETRATION, *EARTHWORK, ENGINEERING, EXCAVATION*, STABILITY, SOIL PHYSICS, SOIL TEMPERATURE, TESTS.

This paper presents the construction procedure, data and analysis from an experimental field program to determine the rippability and compaction characteristics of frozen soil. Also investigated was the stability upon thawing of the frozen soil compacted in the field. From the results of the experimental program, several important conclusions concerning winter earthwork were obtained. 1) Ripping frozen soil can be accomplished with heavy equipment which will produce a large range of chunk sizes. 2) The effectiveness of field compaction of frozen material is highly dependent on the moisture content of the soils. 3) The magnitude of settlement in embankments constructed of frozen material is closely related to the compacted dry density of the placed soil.

SR 80-22

ESTIMATING COSTS OF ICE DAMAGE TO PRIVATE SHORELINE STRUCTURES ON GREAT LAKES CONNECTING CHANNELS.

Carey, K.L., May 1980, 33p., ADA-089 781.

35-2599

STRUCTURES, DAMAGE, ICE LOADS, IMPACT STRENGTH, ICE PRESSURE, ICE NAVIGATION, COST ANALYSIS.

The possible extension of the navigation season through the entire winter or a portion thereof has been under consideration for the Great Lakes and the St. Lawrence Seaway for a number of years. To balance the benefits and costs of such an extension it is necessary to determine the damage costs to shore structures that might result from ice loosened by ship passage. This paper is concerned with the interconnecting channels of the Lakes where there is estimated to be $18,000,000 (1976 dollars) worth of small, private, vulnerable shore structures.

SR 80-23

RADIO-ECHO SOUNDING IN THE ALLAN HILLS, ANTARCTICA, IN SUPPORT OF THE METEORITE FIELD PROGRAM.

Kovacs, A., May 1980, 9p., ADA-086 858, 3 refs.

34-3874

RADIO ECHO SOUNDINGS, GLACIER THICKNESS, GLACIER SURVEYS, ICE COVER THICKNESS, POLLUTION, ANTARCTICA—ALLAN HILLS.

Radio-echo sounding measurements made on Ross Island and in the Allan Hills, Antarctica, indicate that radio-echo sounding may offer the unique possibility of detecting a buried meteorite in glacial ice. The results also revealed internal layering within the snow on Ross Island and in the snow filling an ice depression west of Allan Nunatak. Radio-echo sounding also gave the depth to bedrock near the west side of Allan Nunatak. The greatest ice depth measured was 310 m.

SR 80-24
1979 GREENLAND ICE SHEET PROGRAM. PHASE 1: CASING OPERATION.
Rand, J.H., June 1980, 18p., ADA-089 699, 5 refs.
34-3485
ICE DRILLS, THERMAL DRILLS, GLACIOLOGY, LININGS, GREENLAND.

A modified CRREL thermal drill was used at DYE-3 in Greenland to drill a 8.75-in.-diameter hole 251 ft deep for the installation of a steel casing. This activity was accomplished by a drill team from CRREL in preparation for the Danish deep drill tests. Included in this report is a description of both the drilling and casing operation as well as a description of the equipment used.

SR 80-25
ROOFS IN COLD REGIONS: MARSON'S STORE, CLAREMONT, NEW HAMPSHIRE.
Tobiasson, W., et al, June 1980, 13p., ADA-089 788.
Korhonen, C.
35-975
ROOFS, BITUMENS, COLD WEATHER PERFORMANCE.

A reinforced, single-ply PVC membrane was examined five years after being applied over a leaky, built-up, bituminous membrane. The bare PVC membrane was dirty, poorly drained and littered with broken glass, nails and such, yet no flaws were evident on leaks reported. Even at 0 F the PVC was quite flexible. Diagonal wrinkles at a parapet wall were attributed to workmanship; other observations suggested that membrane shrinkage had not occurred. The membrane has functioned well for five years and years and appears to be in good condition.

SR 80-26
WORKING GROUP ON ICE FORCES ON STRUCTURES.
Carstens, T., ed, June 1980, 146p., ADA-089 674, Refs. passim. For individual articles see 35-508 through 35-511.
35-507
ICE PRESSURE, ICE LOADS, HYDRAULIC STRUCTURES, DAMS, LOADS (FORCES), ICE SOLID INTERFACE, TEMPERATURE VARIATIONS, FLOATING ICE, ICE WEDGES, ICE SHEETS.

SR 80-27
DYNAMICS OF NH4 AND NO3 IN CROPPED SOILS IRRIGATED WITH WASTEWATER.
Iskandar, I.K., et al, June 1980, 20p., ADA-090 575, 6 refs.
Parker, L.V., McDade, C., Atkinson, J., Edwards, A.P.
35-872
WASTE DISPOSAL, WATER TREATMENT, IRRIGATION, SOIL CHEMISTRY, NUTRIENT CYCLE, AGRICULTURE.

The objectives of this field study were 1) to obtain information on the dynamic behavior of wastewater NH4 and NO3 in soils, 2) to determine the relative abundance of NH4 and NO3 in soils receiving wastewater, and 3) to evaluate the seasonal effect on the fate of wastewater NH4 applied to soils in a slow infiltration system. The study was conducted using an on-going test plot which contained two soil types and was covered with forage grass. Samples were collected in June and October to study the seasonal effect on the dynamic of N. The concentrations of NH4 and NO3 in the soil reached a daily, quasi-steady state condition. The seasonal effect on the relative amounts of NH4 and NO3 was similar but there was always more NH4 than NO3. The concentrations of both NH4 and NO3 in soil profile were high at the surface and decreased with depth, consistent with the higher CEC, the slow movement of NH4 in soils, and the higher organic matter content in the surface. Both NH4 and NO3 concentrations were higher in the finer texture Chariton silt loam soil than in the coarser texture Windsor sandy loam soil.

SR 80-28
ICE ADHESION TESTS ON COATINGS SUBJECTED TO RAIN EROSION.
Minsk, L.D., July 1980, 14p., ADA-089 698.
34-3484
ICE ADHESION, ICE PREVENTION, PROTECTIVE COATINGS, HELICOPTERS, TESTS.

Screening tests to select icephobic coatings displaying low ice release forces, both before and after exposure to rain erosion in a whirling arm simulator, were performed on approximately 60 commercial materials. A unique linear ball-slide shear test apparatus was designed to provide pure shear forces. No coating survived the erosion test to give an interfacial shear strength as low as 15 psi (103 kPa), an arbitrarily established goal. Several coatings showed shear strengths between 30 and 45 psi (207 and 310 kPa) after rain erosion.

SR 80-29
POST OCCUPANCY EVALUATION OF A REMOTE AUSTRALIAN COMMUNITY: SHAY GAP, AUSTRALIA.
Bechtel, R.B., et al, July 1980, 57p., ADA-089 675, 8 refs.
Ledbetter, C.B.
35-2600
URBAN PLANNING, HOUSES, BUILDINGS, SITE SURVEYS, ECOLOGY.

A post occupancy evaluation (POE) was made of Shay Gap, an iron mining community in Western Australia. More than 50 design hypotheses were tested with results favoring the original design. Selecting a townsite surrounded by hills was deemed successful by residents. Keeping automobiles out of the living areas increased the safety of children and made residents walk and socialize more. A centrally located building housing the shopping facilities, beauty parlor, bank, post office, and snack bar served as the focal point of the community. Bland, off-white interiors allowed residents to express themselves when decorating. Shay Gap was a successful design concept for communities designed for remote areas in either hot or cold regions.

SR 80-30
DYNAMIC TESTING OF FREE FIELD STRESS GAGES IN FROZEN SOIL.
Aitken, G.W., et al, July 1980, 26p., ADA-089 676, 6 refs.
Albert, D.G., Richmond, P.W.
35-2601
FROZEN GROUND MECHANICS, STRESSES, IMPACT TESTS, SHOCK WAVES, SOIL MECHANICS, WAVE PROPAGATION.

This report describes an attempt to develop a procedure for dynamic calibration of free-field soil stress gages embedded in a soil sample. The method presented utilizes a drop-type impact testing machine and a small, instrumented container of soil. The velocity history of a shock pulse applied to the soil sample is measured and the applied stress computed; this value is then compared with data obtained from stress gages embedded in the soil. The results showed that the procedure is adequate for unfrozen soil, but for frozen soil the accuracy in the measurement of compressional wave velocity needs to be increased to obtain useful results.

SR 80-31
REVIEW OF TECHNIQUES FOR MEASURING SOIL MOISTURE *IN SITU*.
McKim, H.L., et al, Aug. 1980, 17p., ADA-089 974, Refs. p.13-17.
Walsh, J.E., Arion, D.N.
35-976
SOIL WATER, ELECTROMAGNETIC PROPERTIES, TENSILE PROPERTIES, CLIMATIC FACTORS.

Recently there has been an increased interest in the in-situ measurement of soil moisture content in the areas of hydrology, meteorology, agriculture and environmental studies. Current methods generally have limitations, depending upon the use of the data, that greatly influence acquisition and reliability of the soil moisture determination. This report discusses gravimetric, nuclear, electromagnetic, tensiometric and hygroscopic techniques and the advantages and disadvantages of using the techniques. Emphasis is placed on the tensiometric and electromagnetic techniques. These two measurements when coupled would supply information on the wetting and drying soil moisture characteristic curves and thereby provide a means of tracing moisture movement under field conditions in cold climates.

SR 80-32
CHARACTERISTICS OF ICE IN WHITEFISH BAY AND ST. MARYS RIVER DURING JANUARY, FEBRUARY AND MARCH 1979.
Vance, G.P., Aug. 1980, 27p., ADA-089 950, 12 refs.
35-488
ICE BREAKING, ICE COVER THICKNESS, ICE COVER STRENGTH, FLEXURAL STRENGTH, ICE DENSITY, METAL ICE FRICTION, METAL SNOW FRICTION, SNOW DENSITY, SNOW DEPTH, AIR TEMPERATURE.

This report presents data on the full-scale trials of the U.S. Coast Guard Icebreaker *Katmai Bay*, which was tested in plate ice that varied in thickness from 10 to 33 in. (25.4 to 83.82 cm) and had a snow cover of 1 to 6 in. (2.54 to 15.24 cm). In January the average temperature was -5C, and the ice flexural strength was 13,363 lb/sq.ft (640 kPa). In March the average temperature was -2C and the ice flexural strength was 11,643 lb/sq. ft (560 kPa). The specific weight (density) of the ice was 0.894 g/cu cm. The specific weight of the snow was in the area of 0.32 g/cm. The coefficient of friction between the ice/snow and steel plate (coated and uncoated) varied from a low of 0.02 in the dynamic case of ice on the Inerta 160 coating to 0.47 for the static case of snow on a rusty steel plate.

SR 80-33
NEW HAMPSHIRE FIELD STUDIES OF MEMBRANE ENCAPSULATED SOIL LAYERS WITH ADDITIVES.
Eaton, R.A., et al, Aug. 1980, 46p., 20 refs.
Berg, R.L.
35-977
SOIL FREEZING, FROST PENETRATION, SOIL STABILIZATION, SOIL WATER, FROST RESISTANCE, PAVEMENTS, ADMIXTURES, LIMING, DESIGN.

This report describes the construction, instrumentation, and performance of membrane encapsulated soil layer (MESL) pavement test sections at the U.S. Army Cold Regions Research and Engineering Laboratory in Hanover, New Hampshire, from 1973 to 1978. Membrane encapsulated soil layer construction involves using a waterproof membrane to protect low grade soils from absorbing moisture, especially during the freezing process. Most of these lower grade soils are frost-susceptible; in these soils water can be drawn to the freezing zone to form ice lenses, which in turn cause heaving of the surface. Lime, flyash, and sodium chloride were added to a silt material prior to encapsulation. These additives were incorporated to add strength to the silt, absorb excess moisture, and increase its load-supporting capabilities. Results show that 1) the moisture content within the MESL sections remained relatively constant over the five years of testing, 2) a nonencapsulated lime-flyash-stabilized silt material heaved 8.8 times as much as the identical material which was encapsulated, 3) the lime-flyash-stabilized MESL had twice the strength of the plain or salt-stabilized MESL, 4) the silt with the additives had less frost heave within the MESL than the untreated silt. In summary, MESL's can be constructed to perform well in cold regions, thereby replacing high quality aggregates which are being depleted.

SR 80-34
DESIGN AND CONSTRUCTION OF FOUNDATIONS IN AREAS OF DEEP SEASONAL FROST AND PERMAFROST.
Linell, K.A., et al, Aug. 1980, 310p., ADA-090 324, Refs. p.307-310.
Lobacz, E.F.
35-886
PILE STRUCTURES, FOUNDATIONS, PERMAFROST PRESERVATION, FROZEN GROUND MECHANICS, COLD WEATHER CONSTRUCTION, FROST PENETRATION, FROST ACTION, FROST HEAVE, ENGINEERING, SOIL MECHANICS, DESIGN.

This report presents engineering guidance for the design and construction of foundations in areas of deep seasonal frost and permafrost as developed up to the early 1970's. Attention is given to basic considerations affecting foundation design, site investigations, survey datum points, construction considerations, and monitoring performance. Included in the main text are 17 tables, 141 figures, and 213 selected references. A bibliography presents 45 additional references.

SR 80-35
RESINS AND NON-PORTLAND CEMENTS FOR CONSTRUCTION IN THE COLD.
Johnson, R., Sep. 1980, 19p., ADA-092 952, 6 refs.
35-1725
CEMENTS, COLD WEATHER CONSTRUCTION, CONSTRUCTION MATERIALS, RESINS, POLYMERS.

A laboratory investigation was conducted to assess the potential of some resins and non-portland cements for structural concrete at low temperatures. The resins investigated were urethane (non-hydrophilic), epoxy and polyester, as well as a polysulfide polymer. Two non-portland (modified) cements were also tested. The curability of the resins, when mixed with fine aggregate, showed that they had potential for low temperature use in the following decreasing order: urethane, polyester, and epoxy. Of the non-portland cement materials, mixed as individual neat slurries, one showed potential for low temperature use at -10 C (using 3.9 C water).

SR 80-36
INFILTRATION CHARACTERISTICS OF SOILS AT APPLE VALLEY, MINN.; CLARENCE CANNON DAM, MO; AND DEER CREEK LAKE, OHIO, LAND TREATMENT SITES.
Abele, G., et al, Oct. 1980, 41p., ADA 093 350, 5 refs.
McKim, H.L., Brockett, B.E., Ingersoll, J.
35-1726
SOIL WATER MIGRATION, PERMEABILITY, SOIL MECHANICS, SEEPAGE, WASTE TREATMENT, DENSITY (MASS/VOLUME), GRAVITY, TESTS.

Large-scale, 3- to 6-m diameter infiltration tests provide realistic data for determining soil infiltration rates. Tensiometers can be used to monitor the relative degree of saturation during the test. At Apply Valley, Minnesota, the saturated infiltration rate is moderately rapid, at Clarence Cannon Dam, Missouri, the rates range from moderate to slow, and at Deer Creek Lake, Ohio, from moderately slow to slow.

SR 80-37

EFFECTS OF A TUNDRA FIRE ON SOILS AND PLANT COMMUNITIES ALONG A HILLSLOPE IN THE SEWARD PENINSULA, ALASKA.

Racine, C., Nov. 1980, 21p., ADA-094 6607, 21 refs.

35-2602

TUNDRA, FIRES, DAMAGE, SOILS, PLANTS (BOTANY), VEGETATION, SLOPES.

During summer 1977, wildfires burned extensive areas of low arctic tundra in the Seward Peninsula, Alaska. The present study was initiated in July 1978 to determine the effects of these fires on tundra soils and vegetation. Nine 10- x 1-m permanent transects were established at regular intervals along the topographic gradient of a burned hillslope in the central Seward Peninsula near Imuruk Lake. Soil characteristics and plant species density and cover were determined in each of the 90 1- x 1-m plots on this slope during July of both 1978 and 1979.

SR 80-38

THERMAL DIFFUSIVITY OF FROZEN SOIL.

Haynes, F.D., et al, Dec. 1980, 30p., ADA-094 605, 10 refs.

Carbee, D.L., VanPelt, D.J.

35-2603

FROZEN GROUND PHYSICS, THERMAL DIFFUSION, THERMAL CONDUCTIVITY, SPECIFIC HEAT, HEAT TRANSFER, TEMPERATURE EFFECTS, DENSITY (MASS/VOLUME), SOIL WATER, PERMAFROST PHYSICS.

Knowledge of the thermal diffusivity of frozen soils is necessary for transient heat transfer analysis. The specific heat, thermal conductivity and density for a sand, a silt and a clay were obtained experimentally and used to calculate their thermal diffusivity. These properties were measured over a range of temperatures from -50 C to +45 C and for moisture contents from dry to saturated. The use of a differential scanning calorimeter for obtaining specific heat values was proven to be a reliable technique.

SR 80-39

STRUCTURAL EVALUATION OF POROUS PAVEMENT TEST SECTIONS AT WALDEN POND STATE RESERVATION, CONCORD, MASSACHUSETTS.

Eaton, R.A., et al, Dec. 1980, 43p., ADA-094 606, 5 refs.

Marzbanian, P.C.

35-2006

BITUMINOUS CONCRETES, PAVEMENTS, POROUS MATERIALS, BEARING STRENGTH, CONCRETE STRENGTH, STRUCTURAL ANALYSIS, COLD WEATHER PERFORMANCE, LOADS (FORCES), DEFORMATION, TESTS.

This report presents the results of repeated load tests upon various porous pavement test sections constructed in an overflow parking lot at Walden Pond State Reservation in Concord, Massachusetts. From the fall of 1977 to the spring of 1979, the seasonal structural responses of the sections were monitored with a repeated plate bearing apparatus. After the first set of fall and spring tests, some sections were reconstructed because the asphalt concrete pavement was not porous enough. Test points were added or replaced to accommodate the reconstructed sections. Results show that the dense asphalt concrete distributed the load over a greater area than the porous asphalt concrete, thicker pavements were stronger for both dense and porous asphalt concrete, and the deflection basin depth and diameter changed proportionately to applied loads.

SR 80-40

BUILDING UNDER COLD CLIMATES AND ON PERMAFROST; COLLECTION OF PAPERS FROM A U.S.-SOVIET JOINT SEMINAR, LENINGRAD, USSR.

U.S.-Soviet Joint Seminar on Building under Cold Climates and on Permafrost, Leningrad, June 24-29, 1979, Dec. 1980, 365p., ADA-097 516, Refs. passim. For individual papers see 35-1966 through 35-1986.

U.S. Department of Housing and Urban Development, U.S. Army Corps of Engineers.

35-1965

COLD WEATHER CONSTRUCTION, BUILDINGS, PERMAFROST BENEATH STRUCTURES, CLIMATIC FACTORS, MEETINGS.

SR 80-41

EMBANKMENT DAMS ON PERMAFROST IN THE USSR.

Johnson, T.C., et al, Dec. 1980, 59p., ADA-095 141, 24 refs.

Sayles, F.H.

35-2005

EARTH DAMS, PERMAFROST, EMBANKMENTS, THERMAL REGIME, USSR—SIBERIA.

The report documents a study tour of the USSR to determine the current practices in analyzing the thermal regime of embankment dams on permafrost and in application of these practices in designing dams. The results of visits to earth and rockfill dams on permafrost in Siberia are summarized. Discussions with the designers of the dams, and with a construction manager and an operations manager, are recorded. The leading Soviet engineers and scientists specializing in analysis of the thermal regime of embankment dams on permafrost were consulted, and the discussions are summarized. Experimental facilities of institutes concerned with this question also were inspected.

SR 81-01

OVERLAND FLOW: REMOVAL OF TOXIC VOLATILE ORGANICS.

Jenkins, T.F., et al, Feb. 1981, 16p., ADA-097 576, 34 refs.

Leggett, D.C., Martel, C.J., Hare, H.E.

35-2581

WASTE TREATMENT, WATER TREATMENT, FLOODING, LAND RECLAMATION, WATER CHEMISTRY.

A small-scale overland flow system was studied to determine its effectiveness in reducing the levels of volatile trace organics in municipal wastewater. Chlorinated primary wastewater, water collected from the surface at various points downslope, and runoff were analyzed by gas chromatography/mass spectrometry using a purge and trap sampler. The results indicated that overland flow was effective in reducing the levels of these substances by 80-100% depending on the specific substance and the application rate. The removal mechanism was found to follow first order kinetics. The most likely mechanism to explain the observed behavior is volatilization. Comparison of the experimental results with theoretical prediction using published models resulted in reasonable agreement considering the complexity of the system compared to the model systems.

SR 81-02

METHOD FOR COINCIDENTALLY DETERMINING SOIL HYDRAULIC CONDUCTIVITY AND MOISTURE RETENTION CHARACTERISTICS.

Ingersoll, J., Mar. 1981, 11p., ADA-099 136, 3 refs.

35-3644

SOIL WATER, WATER RETENTION, PERMEABILITY, HYDRAULICS, CONDUCTION, DENSITY (MASS/VOLUME), TENSILE PROPERTIES, GLACIAL DEPOSITS, EQUIPMENT.

A constant-head permeameter has been modified to include the essential components of a Tempe cell moisture extractor. With this equipment, tests for saturated hydraulic conductivity (permeability), unsaturated hydraulic conductivity and moisture retention characteristics of the soil can be conducted using the same soil sample. The procedure can be used for both absorption and desorption phases. Test results from four different soils (a glacial till, a fine sand, a silt and a coarse sand) are presented. The effects of density on hydraulic conductivity and moisture retention characteristics are shown.

SR 81-03

INVESTIGATION OF THE SNOW ADJACENT TO DYE-2, GREENLAND.

Ueda, H.T., et al, Mar. 1981, 23p., ADA-099 139, 8 refs.

Goff, M.A., Nielsen, K.G.

35-3651

SNOW STRENGTH, COMPRESSIVE PROPERTIES, SNOW DENSITY, LOADS (FORCES), SNOW DEPTH, DRILL CORE ANALYSIS.

Snow samples from five 50-ft (15.2m) deep holes, augered adjacent to the west side of DEW line Station Dye-2 in Greenland, were investigated for density and unconfined compressive strength. Forty-two percent of the recovered cores were tested. Ninety-three percent of the samples tested had a length/diameter ratio greater than 2:1. The loading rate was 2 in./min (51 mm/min). Sample end-effects appeared to influence a high percentage of the failures. The heavily disturbed nature of the material is evidenced in the widely scattered values of density and strength with depth. A minimum and maximum strength value of 31 psi (0.21 MPa) and 1065 psi (7.34 MPa) respectively were obtained from a hole located 50 ft (15.2 m) from the structure. Using an approach similar to that used prior to the Dye-3 move in 1976, a safety factor exceeding 6.5 is obtained against a brittle bearing failure based on a maximum footing design load of 2000 lb/sq ft (96 kPa).

SR 81-04

PLANT GROWTH ON A GRAVEL SOIL: GREENHOUSE STUDIES.

Palazzo, A.J., et al, Mar. 1981, 8p., ADA-098 598, 9 refs.

Graham, J.M.

35-3692

GRASSES, GROWTH, SOIL STABILIZATION, GRAVEL, NUTRIENT CYCLE.

Two greenhouse studies were performed with gravel soils to determine the requirements for nitrogen (N), phosphorus (P), and potassium (K) for grass establishment and to assess the establishment performance of 15 types of grasses. The fertilizer study consisted of 30 treatments, each representing a different combination of application rates of N, P, and K. A seed mixture containing "Nugget" Kentucky bluegrass, "Pennlawn" red fescue, and annual ryegrass was sown, and the plants were harvested 133 days after sowing. Plant leaf and root weights were measured, and soil samples were analyzed for pH, P, K and soluble salts. In the grass study, 15 grasses were grown for 76 days. All treatments were fertilized at the beginning of the study. Plant establishment was periodically assessed and yields were measured at the end of the study. In the fertilizer study, N and P were shown to be limiting to leaf growth on this soil. Applications of P were the most beneficial for root growth. Needs for K were less evident, but it was required for maximum leaf growth at the higher application rates of N and P. The greatest yields were recorded when all three elements were applied, while at the lower application rates only N and P were required to promote growth.

SR 81-05

UPPER OCEAN TEMPERATURE, SALINITY AND DENSITY IN THE VICINITY OF ARCTIC DRIFT STATION *FRAM* 1, MARCH TO MAY 1979.

McPhee, M.G., Mar. 1981, 20p., ADA-098 597, 2 refs.

35-3706

OCEANOGRAPHY, SALINITY, TEMPERATURE GRADIENTS, DENSITY (MASS/VOLUME), DRIFT STATIONS, ARCTIC OCEAN.

A program designed to measure temperature and conductivity in the upper 270 m of the Arctic Ocean within a 150-km radius of Drift Station FRAM I is described, and data in the form of profiles of temperature, salinity, and density as functions of depth are presented for each of 104 casts made with a portable, self-contained conductivity-temperature-depth instrument. Seventy-five of the casts were made away from the ice station at sites reached by helicopter. Details of sampling procedure, instrument calibration, and data organization are given.

SR 81-06

INTRODUCTION TO THE BASIC THERMODYNAMICS OF COLD CAPILLARY SYSTEMS.

Colbeck, S.C., Mar. 1981, 9p., ADA-099 138, 9 refs.

35-3712

THERMODYNAMICS, CAPILLARITY, FROZEN GROUND THERMODYNAMICS, WET SNOW, ICE CRYSTAL GROWTH, ENTHALPY, ANALYSIS (MATHEMATICS).

The basic principles of phase equilibrium thermodynamics are reviewed. These principles are used to derive several useful relations such as osmotic pressure and Kelvin's equation. Several examples are given of the application of thermodynamics to cold regions materials such as grain growth in wet snow and capillary condensation in rocks.

SR 81-07

LABORATORY AND FIELD USE OF SOIL TENSIOMETERS ABOVE AND BELOW 0 DEG C.

Ingersoll, J., Apr. 1981, 17p., ADA-101 561, 8 refs.

35-3796

SOIL MECHANICS, SOIL WATER, WATER RETENTION, DENSITY (MASS/VOLUME), TENSILE PROPERTIES, FROST PENETRATION, TEMPERATURE EFFECTS, MEASURING INSTRUMENTS.

Methods for using tensiometers in conjunction with moisture retention characteristic curves for non-destructive soil water measurements are presented for above- and below-freezing situations of engineering interest. Four methods for determining moisture retention characteristics, three tensiometer types, and several methods of recording soil suction are discussed. Procedures for preparing, modifying and installing tensiometers for field use in cold climates are explained. Several examples of moisture retention characteristics are shown, including the effect of soil density on water retention. Examples of soil tension ahead of and behind a frozen soil zone are also presented.

SR 81-08

SUBLIMATION AND ITS CONTROL IN THE CRREL PERMAFROST TUNNEL.

Johansen, N.I., May 1981, 12p., ADA-101 555, 3 refs.

Chalich, P.C., Wellen, E.W.

35-3736

SUBLIMATION, PERMAFROST PRESERVATION, DUST CONTROL.

The U.S. Army Cold Regions Research and Engineering Laboratory's permafrost tunnel at Fox, near Fairbanks, Alaska, was used to investigate the sublimation process in permafrost silt. The rate of increase in thickness of the dried silt layer from sublimation was found to be approximately 0.023 in. (0.058 cm) in 1 month and closely related to the relative humidity in the tunnel. Sublimation prevention studies consisted of evaluation of various membranes to impede the sublimation. Ice was found to show promise as an easily installed, effective membrane when applied as a fine water mist and subsequently left to freeze.

SR 81-09

ICE JAM PROBLEMS AT OIL CITY, PENNSYLVANIA.

Deck, D.S., et al, May 1981, 19p., ADA-103 736, 9 refs.

Gooch, G.

36-179

ICE JAMS, FLOOD CONTROL, ICE CONDITIONS.

Oil City, Pennsylvania, is at the confluence of Oil Creek and the Allegheny River. The business district lies within the flood plain of Oil Creek, and as ot the winter of 1980, 25 ice jam flooding events had occurred since the mid-

1800's. An investigation was done to determine why Oil City was subject to perennial ice jams and nearly biennial ice jam floods. Ice conditions were analyzed and it was determined how and why the jams occurred. By controlling where the initial ice cover forms, Oil City's ice jam floods can be alleviated. Ice control structures will be used to encourage the early formation of ice cover and hence eliminate frazil ice. This will greatly reduce the amount of ice which currently develops in both Oil Creek and the Allegheny River.

SR 81-10

FABRIC INSTALLATION TO MINIMIZE REFLECTION CRACKING ON TAXIWAYS AT THULE AIRBASE, GREENLAND.

Eaton, R.A., et al, May 1981, 26p., ADA-103 737, 2 refs.

Godfrey, R.

36-407

RUNWAYS, CRACKING (FRACTURING), COUNTERMEASURES, BITUMENS, CONCRETE DURABILITY, CONCRETE STRENGTH.

In August 1978 two types of fabrics were placed on sections of taxiways 1 and 3 of Thule AB, Greenland, to study the ability of fabrics with an AC 2.5 overlay to minimize reflection cracking in severe climates. Both fabrics should retain durability and mechanical strength under Thule's arctic conditions.

SR 81-11

METHOD FOR MEASURING BRASH ICE THICKNESS WITH IMPULSE RADAR.

Martinson, C.R., et al, June 1981, 10p., ADA-103 738, 3 refs.

Dean, A.M., Jr.

36-377

ICE FLOES, ICE COVER THICKNESS, LAKE ICE, RADAR ECHOES.

During March 1980 a subsurface impulse radar system was successfully used on board a U.S. Coast Guard cutter to measure brash ice thickness in the Great Lakes. Manual ice thickness measurements were made in the test area to calibrate the radar data and to determine radar range settings. Radar-collected data were recorded on magnetic tape and later played back to a graphic recorder for interpretation. Most of the usable data were collected when the ship's speed was 3-4 knots.

SR 81-12

SEVEN-YEAR PERFORMANCE OF CRREL SLOW-RATE LAND TREATMENT PROTOTYPES.

Jenkins, T.F., et al, July 1981, 25p., ADA-103 739, 6 refs.

Palazzo, A.J., Schumacher, P.W., Hare, H.E., Butler, P.L., Diener, C.J., Graham, J.M.

36-776

WASTE TREATMENT, WATER TREATMENT. LAND RECLAMATION, WATER CHEMISTRY, NUTRIENT CYCLE, STATISTICAL ANALYSIS, SOIL WATER.

A set of six outdoor, slow-rate land treatment prototypes was operated from June 1973 through May 1980. Water quantity and quality data are presented for the wastewater applied to and the percolate leaving the 5-foot soil profile. Average concentration, mass loading and mass and percentage removal of wastewater constituents are presented on a yearly basis. Tabulations of crop production and nutrient uptake are also presented. Nutrient balance sheets summarize the relative amounts removed by plant uptake, deep percolation and other removal mechanisms for nitrogen and phosphorus.

SR 81-13

EFFECTS OF ICE ON COAL MOVEMENT VIA THE INLAND WATERWAYS.

Lunardini, V.J., et al, June 1981, 72p., ADA-103 740, 31 refs.

Minsk, L.D., Phetteplace, G.

36-939

ICE COVER EFFECT, CHANNELS (WATERWAYS), COAL, FUEL TRANSPORT, LOCKS (WATERWAYS), MARINE TRANSPORTATION, COLD WEATHER PERFORMANCE, DAMS.

The part of the Inland Waterways which carries significant coal and which may experience significant ice problems includes the following rivers or waterways: Ohio, Monogahela, Allegheny, Kanawha, Upper Mississippi, and Illinois. Coal transportation along these rivers may be locally interrupted for periods up to 30 days or more every three to five years. Coal handling facilities, navigation channels, and lock and dam sites along the ice prone rivers were surveyed by visit or telephone to ascertain the scope of the ice problems. The importance of ice as a barrier to increased coal movement on the waterways studied manifests itself differently for each link of the flow system. In order of importance the ice will affect the navigation channels, locks and dams, and finally the coal loading/unloading facilities. The coal handling facilities will not be significantly slowed down by ice problems associated with winter navigation.

SR 81-14

LOSSES FROM THE FORT WAINWRIGHT HEAT DISTRIBUTION SYSTEM.

Phetteplace, G., et al, June 1981, 29p., ADA-103 741, 6 refs.

Willey, W., Novick, M.A.

36-351

HEAT LOSS, ELECTRIC POWER, PIPELINES, STEAM, THERMAL INSULATION, COMPUTER APPLICATIONS, ANALYSIS (MATHEMATICS).

This report estimates the heat losses from the heat distribution system at Fort Wainwright, Alaska. Specific data on the Fort Wainwright heat and power plant are given and a method is then developed to calculate the heat losses from buried utilidor systems, such as the one at Fort Wainwright. This method is programmed for computer execution and estimates are made for the Fort Wainwright system, where heat losses are found to be 204,500 MBtu/yr. Possible improvements to the system to reduce heat losses are examined. Of the possible combinations of additional pipe insulation investigated, the addition of 1 in. of insulation to the steam pipe only is the most economically favorable. The results also indicate that insulating only the generally larger pipes found in larger utilidors would be the most economically favorable approach. Possible reductions in heat losses due to reduced steam temperature are also given, as well as recommendations for refinement of the predictions.

SR 81-15

LIMNOLOGICAL INVESTIGATIONS: LAKE KOOCANUSA, MONTANA. PT. 5: PHOSPHORUS CHEMISTRY OF SEDIMENTS.

Iskandar, I.K., et al, July 1981, 9p., ADA-107 049, 13 refs.

Shukla, S.S.

36-1122

LIMNOLOGY, LACUSTRINE DEPOSITS, CHEMICAL COMPOSITION, BOTTOM SEDIMENT.

This study characterizes the sediments from Lake Koocanusa (Libby Dam reservoir), Montana, in terms of their ability to sorb and release P. Sediment samples were collected at 12 stations located between the U.S.-Canadian border and Libby Dam (42 miles downstream of the border) during July 1977. The sediments from Lake Koocanusa are calcareous, low in organic matter (< 2.3%), and have a silty loam or loam texture. Most of the P associated with these sediments was in the inorganic form (> 85%), which was highly correlated ($r=0.89$) with oxalate extractable Fe in the sediment. Sorption tests, with concentrations of either 1 or 10 mg P/g sediments, showed that these sediments have limited ability to sorb additional P from concentrated solutions. The maximum amount sorbed at the lower P concentrations was 67% of the added P and was highly correlated with oxalate extractable Fe in the sediments. Desorption studies showed that very small amounts of both the originally bound P (1 to 2%) and the added P (< 6.3%) were released. Conclusion: the sediments in Lake Koocanusa act as a P sink.

SR 81-16

PROCEEDINGS OF THE INTERNATIONAL SOCIETY FOR TERRAIN-VEHICLE SYSTEMS WORKSHOP ON SNOW TRACTION MECHANICS, ALTA, UTAH, JAN. 29-FEB. 2, 1979.

Harrison, W.L., ed, July 1981, 71p., ADA-106 972, Refs. passim. For individual papers see 36-1391 through 36-1397.

36-1390

SNOW MECHANICS, SNOW COMPRESSION, TRACTION, TRAFFICABILITY, VEHICLE WHEELS, TRACKED VEHICLES, MEETINGS, MATHEMATICAL MODELS.

This report reviews the state of the art of snow traction mechanics and presents the results of a limited field exercise that allowed participants to observe and practice current snow measurement processes and vehicle test procedures. The prime recommendations of the workshop attendees were 1) the use of parameters basic to the laws of physics for the classification of snow strength, and 2) the use of instrumented tracked and wheeled vehicles for snow strength measurements.

SR 81-17

MACROSCOPIC VIEW OF SNOW DEFORMATION UNDER A VEHICLE.

Richmond, P.W., et al, July 1981, 20p., ADA-107 038, 10 refs.

Blaisdell, G.L.

36-1193

SNOW DEFORMATION, SNOW COMPRESSION, LOADS (FORCES), VEHICLES, SNOW DENSITY, STRESSES, SNOW COMPACTION, TESTS.

In this report the deformation of snow under a vehicle is discussed. For snow with an initial density of less than 0.45 Mg/cu m, load transfer through shallow snow is shown to be attenuated by an interfacial boundary force. Evidence is presented that shows the existence of a density distribution in the deformed area. Results of a laboratory plate-sinkage test on sintered snow support this analysis. Maximum values obtained for the interfacial boundary force range from 1355 to 2670 N when the average density of the deformed area is about 0.5 Mg/cu m.

SR 81-18

BOTTOM HEAT TRANSFER TO WATER BODIES IN WINTER.

O'Neill, K., et al, Sep. 1981, 8p., ADA-106-977.

Ashton, G.D.

36-972

WATER TEMPERATURE, FREEZING POINTS, HEAT FLUX, HEAT TRANSFER, BOTTOM SEDIMENT, LIMNOLOGY, LAKES, PONDS, WINTER.

In many surface water bodies, water temperature closely follows ambient air temperature. This means that warmer water in winter absorbs heat from below. The extent and pattern of winter heat gain is constrained by the fact that the water temperature does not fall below the freezing point. On the basis of a few simple assumptions, governing equations are solved here pertaining to heat flow in bottom sediments. The results are presented in general nondimensionalized curves. These allow estimation of water/sediment heat flux for any particular case, given truncation of the water temperature curve at the freezing point. The user must supply pertinent yearly air temperature mean and amplitude of variation, together with the thermal diffusivity for the bottom material. The governing equations are solved using a higher order finite element method which solves directly for temperature gradients and hence for heat flux. Thus the method provides particularly accurate flux values at high efficiency. The results illustrate in detail how winter water heat gain is less in cases where mean air temperatures are lower.

SR 81-19

MIZEX—A PROGRAM FOR MESOSCALE AIR-ICE-OCEAN INTERACTION; EXPERIMENTS IN ARCTIC MARGINAL ICE ZONES. 1. RESEARCH STRATEGY.

Wadhams, P., ed, June 1981, 20p., ADA-107 046, 59 refs.

Martin, S., ed, Johannessen, O.M., ed, Hibler, W.D., III, ed, Campbell, W.J., ed.

36-1310

ICE AIR INTERFACE, ICE WATER INTERFACE, ICE EDGE, SEA ICE DISTRIBUTION, RESEARCH PROJECTS, CLIMATIC FACTORS, SEA WATER, WATER TEMPERATURE.

This document describes the research strategy for a series of mesoscale studies of arctic marginal ice zones. The main goal of this program is to gain a better understanding of the processes occurring at the ice margin. These processes are relevant to climate, weather forecasting, petroleum exploration and production, marine transportation, naval operations, and commercial fisheries. In addition MIZEX will aid in determining what modifications to existing ice-ocean-atmospheric models are needed for better prediction near the ice margin.

SR 81-20

MINE/COUNTERMINE PROBLEMS DURING WINTER WARFARE. FINAL REPORT OF A WORKSHOP.

Lunardini, V.J., ed, Sep. 1981, 43p., ADA-107 047.

36-973

EXPLOSIVES, COLD WEATHER PERFORMANCE, SNOW COVER EFFECT, BLASTING, FROZEN GROUND, RESEARCH PROJECTS.

The possibility of modern warfare being waged under cold weather conditions has raised questions about the effectiveness of conventional and new mine systems during the winter. A workshop on mine/countermine winter warfare was held at the U.S. Army Cold Regions Research and Engineering Laboratory, 21-23 October 1980, to define problems related to cold climates. The designer, developer and user communities sent 22 representatives from 16 organizations outside of CRREL. Discussion papers were prepared by four groups, covering emplacement of mines, mine performance, detection of mines, and neutralization of mines. The emphasis was on the unique problems of the winter environment. It appears that the U.S. has the capability to conduct defensive warfare during the summer but is not adequately prepared for mine/countermine winter warfare. Test and research programs are called for to compensate for the prior lack of consideration of the winter environment, to adequately winterize new mine/countermine systems, and to formulate appropriate doctrine for defensive winter warfare.

SR 81-21

POTHOLE PRIMER—A PUBLIC ADMINISTRATOR'S GUIDE TO UNDERSTANDING AND MANAGING THE POTHOLE PROBLEM.

Eaton, R.A., et al, Sep. 1981, 24p., ADA-107 294, 11 refs.

Joubert, R.H., Wright, E.A.

36-1114

PAVEMENTS, DEFECTS, ROAD MAINTENANCE, FREEZE THAW CYCLES, DAMAGE, FATIGUE.

SR 81-22
SURFACE DRAINAGE DESIGN FOR AIRFIELDS AND HELIPORTS IN ARCTIC AND SUBARCTIC REGIONS.

Lobacz, E.F., et al, Sep. 1981, 56p., ADA-107 293, 40 refs.
Eff, K.S.
36-974
AIRPORTS, SURFACE DRAINAGE, ROAD ICING, PERMAFROST DISTRIBUTION, COLD WEATHER CONSTRUCTION, DESIGN CRITERIA, ENVIRONMENTAL IMPACT, HELICOPTERS, ENGINEERING.

This report presents engineering guidance and design criteria for drainage facilities at Army and Air Force airfields and heliports in arctic and subarctic regions. Attention is given to hydrologic criteria, icings, environmental impact, storm drains and design computer programs. A design example and a list of 40 references are included in two appendixes.

SR 81-23
ELECTROMAGNETIC SUBSURFACE MEASUREMENTS.

Dean, A.M., Jr., Oct. 1981, 19p., ADA-108 192.
36-1037
ICE COVER, PROFILES, ELECTROMAGNETIC PROSPECTING, AIRBORNE RADAR, SUBGLACIAL OBSERVATIONS, REMOTE SENSING, ICE BOTTOM SURFACE, FRAZIL ICE, ICE JAMS, PERMAFROST, OIL SPILLS.

In 1974 personnel at the U.S. Army Cold Regions Research and Engineering Laboratory (CRREL) began using an impulse radar system to profile accumulations of ice forms. Through field experience the system has been modified so that it can be effectively used as a profiling system, in a ground or airborne configuration, in certain high-noise environments. The system can penetrate fresh water and media with a high water content. For instance, frazil and brash ice accumulations with approximately 50% water have been profiled to a depth of 25 to 35 ft. As a result of the CRREL modifications, the system has found extensive and varied applications as a low-level remote sensing tool. Applications include profiling ice accumulations (including ice jams), river beds, sheet ice, permafrost, subsurface ice masses, river bank revetments through air-entrained water, snow covers, sea ice, icebergs, and peat bogs. Limited laboratory work has also shown that the impulse radar system may be able to detect oil and gas under sea ice. Selected applications and data are presented. Since it has been used mainly for research, the CRREL system needs further development to make it useful to operational units. Additional development of hardware and software is recommended.

SR 81-24
SITE INVESTIGATIONS AND SUBMARINE SOIL MECHANICS IN POLAR REGIONS.

Chamberlain, E.J., Oct. 1981, 18p., ADA-108 269, 44 refs.
36-1644
SUBSEA PERMAFROST, SOIL MECHANICS, FROZEN GROUND MECHANICS, OCEAN BOTTOM, OFFSHORE DRILLING, OFFSHORE STRUCTURES, SITE SURVEYS, POLAR REGIONS, BEAUFORT SEA.

Placing oil exploration and production structures offshore in the Alaskan Beaufort Sea will require careful site investigation and evaluation of submarine soil mechanics. Ice-bounded permafrost occurs widely under the Beaufort Sea floor. Its engineering properties are important to the design of offshore structures. Highly overconsolidated clays also occur widely and interfere with access to gravels for constructing artificial islands. Sites should be selected to avoid ice-rich permafrost. Laboratory tests may need to be conducted to determine the potential hazards of thaw consolidation and weakening.

SR 81-25
FOUNDATIONS OF STRUCTURES IN POLAR WATERS.

Chamberlain, E.J., Oct. 1981, 16p., ADA-108 344, 29 refs.
36-1410
OFFSHORE STRUCTURES, FOUNDATIONS, HYDRAULIC STRUCTURES, OFFSHORE DRILLING, ARTIFICIAL ISLANDS, ICE LOADS, SUBSEA PERMAFROST, SEA ICE, SEASONAL FREEZE THAW, PILE STRUCTURES, SITE SURVEYS, BEAUFORT SEA.

Artificial islands and gravity- and pile-founded towers used for the exploration and production of petroleum resources in the Alaskan Beaufort Sea will be affected by conditions not found in more temperate waters. The force of sea ice, the thawing of subsea permafrost, and seasonal freezing and thawing all may cause failure of the foundations of these structures. To ensure the stability of foundations and fill structures, special precautions must be taken in selecting sites and evaluating the engineering properties of sea bed and fill materials.

SR 81-26
IDENTIFYING AND DETERMINING HALOCARBONS IN WATER USING GAS CHROMATOGRAPHY.

Leggett, D.C., Oct. 1981, 13p., ADA-108 345, 50 refs.
36-1749
WASTES, WATER CHEMISTRY, HYDROCARBONS, CHEMICAL ANALYSIS.

Since the discovery that chloroform and other haloforms are produced during water chlorination, methods have been needed for their routine analysis. This report describes application of the multiple equilibration headspace technique for the determination of halocarbons in water. This method has certain advantages over solvent extraction and direct injection techniques, including greater sensitivity because of the favorable gas/liquid distribution ratios. It is simpler and faster than purge and trap and resin sorption methods and gives more information about compound identity than single headspace analysis because gas/liquid distribution ratios are determined experimentally. The method is absolute, unlike solvent extraction, resin sorption, purge and trap, and conventional headspace analysis, which require standard additions to correct for incomplete recovery. The use of the technique to analyze chlorinated water samples for haloforms revealed a potential problem in their analysis. Haloforms continued to form for 24 hours, even after destruction of chlorine residuals with thiosulfate. Maximum haloform concentrations were observed in undechlorinated samples only after a 48-hour aging period.

SR 81-27
SYNOPTIC METEOROLOGY DURING THE SNOW-ONE FIELD EXPERIMENT.

Bilello, M.A., Nov. 1981, 55p., ADA-109 080, 3 refs.
36-1821
SYNOPTIC METEOROLOGY, METEOROLOGICAL DATA, SNOWFALL, MEASURING INSTRUMENTS, MAPPING.

The daily atmospheric pressure systems and weather fronts that traversed the northeastern United States during the SNOW-ONE Field Experiment from 11 January through 20 February 1981 are summarized. This experiment is the first in a planned series of measurements to study the influence of atmospheric obscurants on electro-optical system performance. The analysis of the large-scale synoptic patterns that developed during the field test period constitutes a critical component of the research program. The weather during the measurement period included nine new daily high temperature records. January was one of the driest and February was one of the wettest ever observed. These conditions were caused in part by two high pressure cells and two major low pressure systems that crossed the region. One of these lows brought warm air and heavy rain to New England, and the other produced significant snowfall in northern Vermont.

SR 81-28
SITE SELECTION METHODOLOGY FOR THE LAND TREATMENT OF WASTEWATER.

Ryan, J.R., et al, Nov. 1981, 74p., ADA-108 636, Refs. p.46-49.
Loehr, R.C.
36-1853
WASTE DISPOSAL, WATER TREATMENT, LAND RECLAMATION, SITE ACCESSIBILITY.

A methodology is presented that covers facets of site selection from preliminary screening to field data acquisition for the preparation of a final design for a land treatment system. The basic assumption underlying the methodology is an approach to site selection in which the entire study area is investigated for potential sites while considering the whole spectrum of land treatment processes. Due to the extensive nature of such a study, several iterations are required to determine the most feasible site and land treatment alternatives. The methodology is presented in three parts. Level I defines the technical feasibility of implementing land treatment for a particular wastewater problem. The boundaries of the study area are defined and available land areas are rated for their suitability for land treatment based on topography, land use, hydrogeology and soil characteristics. A preliminary design for each suitable level I site candidate is prepared in the level II site analysis. The design is based on an evaluation of soil/waste interactions that considers responses to limiting soil conditions. A cost-effectiveness evaluation of waste treatment alternatives and site candidates is developed in level II. The most cost-effective site candidate is then selected for intensive level III field investigations. Data acquired in the level III field investigations will determine the design requirements of the land treatment system.

SR 81-29
MOBILITY BIBLIOGRAPHY.

Liston, N., comp, Nov. 1981, 313p., ADA-108 228.
Hutt, M., comp, White, L., comp.
36-1491
TRAFFICABILITY, VEHICLES, BIBLIOGRAPHIES, TRANSPORTATION, SNOW VEHICLES, AIR CUSHION VEHICLES, TRACKED VEHICLES, SNOW STRENGTH, SOIL STRENGTH.

This bibliography is an international compilation of literature relating to terrain vehicles, amphibious vehicles, snow vehicles, air cushion vehicles, tracked vehicles, wheeled vehicles, and off-road vehicles. It also covers the related subjects of rolling resistance, traction, snow strength measurement, soil strength measurement, terrain analogs, vehicle models, and the overall topic of vehicle mobility. It is not comprehensive but begins at about 1970 and ends in 1980. The European coverage is lacking because much of this material is not accessible by computerized literature searching, which was the mechanism used for compiling this bibliography.

SR 81-30
PREDICTING WHEELED VEHICLE MOTION RESISTANCE IN SHALLOW SNOW.

Blaisdell, G.L., Dec. 1981, 18p., ADA-147 117, 14 refs.
39-872
RUBBER SNOW FRICTION, SNOW COMPACTION, VEHICLE WHEELS, SNOW DEPTH, SNOW COVER EFFECT, TRAFFICABILITY, VELOCITY, FORECASTING, MATHEMATICAL MODELS.

A vehicle traveling through snow is required to expend a greater amount of energy than is necessary when traveling on a rigid surface. Visually, this energy difference can be explained by the formation of a rut. Various attempts have been made in the past to equate the energy of compaction to vehicle motion resistance. However, many of the previous models use information gathered through the application of a vertical force (with a plate-sinkage device) to predict the horizontal motion resisting force. In an attempt to more accurately quantify the relationship between snow compaction and vehicle motion resistance, a vectorial analysis of compaction by a wheel is performed. A method for separating the compaction due to vehicle weight and forward thrust (horizontal propulsion) is suggested. Two methods of using this compaction force breakdown with field-generated data are proposed for the calculation of vehicle motion resistance in shallow snow.

SR 81-31
ROOF MOISTURE SURVEY: RESERVE CENTER GARAGE, GRENIER FIELD, MANCHESTER, N.H.

Tobiasson, W., et al, Dec. 1981, 18p., ADA-110 135, 6 refs.
Coutermarsh, B.A., Greatorex, A.
36-2430
ROOFS, WATERPROOFING, MOISTURE, THERMAL INSULATION, WETTABILITY, BITUMENS, INFRARED EQUIPMENT, DRAINS, TEMPERATURE MEASUREMENT, MEASURING INSTRUMENTS.

An insulated roof with a badly blistered bituminous builtup membrane was surveyed with a hand-held infrared camera to locate areas of wet insulation. Several thermal patterns were observed. Core samples were taken to determine moisture contents. Core samples verified that one thermal anomaly was caused by the increased thickness of bitumen. All other anomalies were caused by wet urethaneperlite composite insulation. Some insulation boards contained much more moisture near the edges than at the center, but others were more uniformly wet. Dramatically different thermal patterns resulted. A few nuclear and capacitance readings, taken for comparison purposes, showed that extra bitumen adversely affects such sensing methods. Because of the amount of wet insulation and the condition of the membrane, both should be removed. The new roofing system for this building should have internal drains and be provided with a sloped surface.

SR 81-32
AUTOMOTIVE COLD-START CARBON MONOXIDE EMISSIONS AND PREHEATER EVALUATION.

Coutts, H.J., Dec. 1981, 37p., ADA-112 170, 7 refs.
36-2751
ENGINE STARTERS, VEHICLES, COLD WEATHER OPERATION, AIR POLLUTION, TEMPERATURE EFFECTS.

Fairbanks and Anchorage, Alaska, experience high wintertime ambient levels of carbon monoxide (CO). Emissions from starting automobile engines in cold weather are thought to be a major source of CO. A quantitative procedure for determining startup CO was developed. The startup emissions were measured as a function of soak time at several low ambient temperatures. The performance of engine preheaters in reducing the startup CO at the various soak times and temperatures was estimated. The data scatter was too great to draw any firm conclusions; however, the length of cold-soak time appeared to have a stronger effect on cold-start CO emissions than did soak temperatures (0 to -30C). Compared to no preheat, continuous preheat during an overnight cold soak can reduce the cold-start CO emissions by 20 to 90%.

SR 81-33
EFFECT OF SOIL TEMPERATURE AND PH ON NITRIFICATION KINETICS IN SOILS RECEIVING A LOW LEVEL OF AMMONIUM ENRICHMENT.

Parker, L.V., et al, Dec. 1981, 27p., ADA-112 171, Refs. p.17-20.
Iskandar, I.K., Leggett, D.C.
36-2752
SOIL CHEMISTRY, SOIL TEMPERATURE, NUTRIENT CYCLE, WASTE TREATMENT, SOIL MICROBIOLOGY.

Two soil samples from an on-going field study of land application municipal wastewater were spiked with low levels of ammonium to determine the effect of temperature on nitrification kinetics. The concentrations of ammonium and nitrite-plus-nitrate, and the number of autotrophic ammonium and nitrite oxidizers were monitored periodically during the study. There was a lag period prior to nitrite-plus-nitrate production at all temperatures, and the length of this lag period was temperature-dependent, with the longest period occuring at the lowest temperature. The maximum rate of nitrification increased with temperature as expected. While nitrite-plus-nitrate production appeared logarithmic, suggesting a growing nitrifier population, the MPB counts of the nitrifiers did not exhibit logarithmic growth. To study the effect of soil pH on nitrification kinetics, soil samples from field plots having the same soil type but different pHs (4.5, 5.5, and 7.0) were spiked with low levels of ammonium and the rate of nitrite-plus-nitrate production was measured. The maximum rate of nitrification was greater at pH 5.5 than at 4.5. Unexpectedly rapid disappearance of ammonium, nitrite and nitrate, caused by immobilization, obscured the expected effects of pH on the nitrification rate at the highest pH.

SR 81-34
SEA ICE RUBBLE FORMATIONS IN THE BERING SEA AND NORTON SOUND, ALASKA.
Kovacs, A., Dec. 1981, 23p., ADA-113 773, 22 refs.
36-2841
PRESSURE RIDGES, ICE PRESSURE, SEA ICE, OFFSHORE STRUCTURES, ICE LOADS, ICE FORMATION, ICE SURFACE, OFFSHORE DRILLING, GROUNDED ICE, FLOATING ICE.

The occurrence of large, compact, grounded pressure ridge formations up to 15 m high in the coastal waters of Norton Sound and the Bering Sea is discussed. These formations periodically float free and drift about, gouging the seabed. Their mass makes them a severe threat to both floating and bottom-founded structures in these waters.

SR 82-01
OVERVIEW OF MODELS USED IN LAND TREATMENT OF WASTEWATER.
Iskandar, I.K., Mar. 1982, 27p., ADA-114 403, Refs. p.22-27.
36-2910
LAND RECLAMATION, WASTE TREATMENT, WATER TREATMENT, NUTRIENT CYCLE, MATHEMATICAL MODELS, SOIL MICROBIOLOGY, SOIL WATER, SOIL CHEMISTRY.

This report summarizes the state of the art of the modeling of wastewater renovation by land treatment. The models discussed are classified based on their use for planning, site selection and cost analysis, and for predicting 1) water and salt transport in soils, 2) nitrogen transport and transformations, 3) phosphorus transport and transformations, 4) virus movement in soils, and 5) toxic metal and trace organic movement in soils. This report compares the different models as to their purpose, input and output data, and status of validation. In addition, the report includes a section on research needs for modeling land treatment of wastewater.

SR 82-02
TESTING SHAPED CHARGES IN UNFROZEN AND FROZEN SILT IN ALASKA.
Smith, N., Mar. 1982, 10p., ADA-113 670, 2 refs.
36-2742
EXPLOSION EFFECTS, BLASTING, FROZEN GROUND STRENGTH, SOIL STRENGTH, BOREHOLES, TESTS.

SR 82-03
SECOND NATIONAL CHINESE CONFERENCE ON PERMAFROST, LANZHOU, CHINA, 12-18 OCTOBER 1981.
Brown, J., et al, Mar. 1982, 58p., ADA-114 445.
Yen, Y.-C.
39-871
PERMAFROST, FROZEN GROUND, RESEARCH PROJECTS, MEETINGS, GEOCRYOLOGY, CHINA.

The Second National Chinese Conference on Permafrost was attended by the authors, and visits were made to two research institutes in Lanzhou, the Northwest Institute of the China Academy of Railway Sciences and the Institute of Glaciology and Cryopedology. Approximately 100 papers were presented at the conference and 180 abstracts were published. The papers were presented during three sessions: 1) *Distribution, Characteristics and Formation of Frozen Ground*, 2) Basic Physico-Mechanical Properties and Processes *in Frozen Soils*, and 3) Engineering Design and Construction in Permafrost. Sixty-nine institutions conducting frozen ground research in China were represented. It was planned to present selected papers from this conference at the Fourth International Conference on Permafrost in Fairbanks, Alaska, in 1983.

SR 82-04
PRELIMINARY ASSESSMENT OF THE NUTRIENT FILM TECHNIQUE FOR WASTEWATER TREATMENT.
Bouzoun, J.R., et al, Mar. 1982, 15p., ADA-115 425, 12 refs.
Palazzo, A.J.
36-3112
WASTE TREATMENT, WATER TREATMENT, SANITARY ENGINEERING, PLANTS (BOTANY), GROWTH, STATISTICAL ANALYSIS.

An experiment was conducted to determine the feasibility of using a solar powered, self-regenerating plant growth system, called the nutrient film technique (NFT), to treat primary effluent (average temperature, 11.1C). Primary effluent was pumped onto the elevated end of a sloping waterproof 2-x40-ft plywood tray and trickled through the root mat of reed canarygrass. The quantity of influent and effluent was measured as well as temperature, pH, total suspended solids, volatile suspended solids, BOD5, total nitrogen, ammonia nitrogen, nitrate nitrogen, total phosphorus, phosphate phosphorus, and fecal coliform organisms. The quantity and quality of the reed canarygrass was determined from samples taken from six harvests. Mass balances are presented for BOD5, total suspended solids, total nitrogen, ammonia nitrogen, total phosphorus, and phosphate phosphorus. The removal of several volatile trace organic compounds was determined on two separate dates.

SR 82-05
PLANT GROWTH AND MANAGEMENT FOR WASTEWATER TREATMENT IN OVERLAND FLOW SYSTEMS.
Palazzo, A.J., Apr. 1982, 21p., 25 refs.
36-3113
WASTE TREATMENT, WATER TREATMENT, LAND RECLAMATION, PLANTS (BOTANY), GROWTH, GRASSES.

Domestic wastewater was applied over a four-year period at various rates to three overland flow test slopes to study forage grass growth and nutrient removal. The annual application rates of nitrogen and phosphorus ranged up to 2026 and 226 kg/ha, respectively. The forage grasses were harvested three times per season. Plant yields, composition and uptake of nutrients were determined. The results show that reed canarygrass, quackgrass and Kentucky bluegrass were the most persistent grasses on the slope over the four years.

SR 82-06
METEOROLOGICAL CONDITIONS CAUSING MAJOR ICE JAM FORMATION AND FLOODING ON THE OTTAUQUECHEE RIVER, VERMONT.
Bates, R., et al, May 1982, 25p., ADA-116 386, 15 refs.
Brown, M.-L.
39-873
ICE JAMS, FLOODING, METEOROLOGICAL FACTORS, ICE BREAKUP, RIVER ICE, RIVER FLOW, PRECIPITATION (METEOROLOGY), UNITED STATES—VERMONT—OTTAUQUECHEE RIVER.

This report discusses wintertime meteorological conditions that can induce rapid ice breakup, ice jam formation and subsequent flooding. These conditions, described for the Ottauquechee River in Vermont, should be representative of those for similar unregulated river systems in northern temperate regions. Summer flood conditions are compared to those during winter floods, when river ice is the main impediment to water flow. Comparisons are made for total precipitation, stage height and the synoptic meteorological situations.

SR 82-07
MOISTURE DETECTION IN ROOFS WITH CELLULAR PLASTIC INSULATION—WEST POINT, NEW YORK, AND MANCHESTER, NEW HAMPSHIRE.
Korhonen, C., et al, May 1982, 22p., ADA-117 872, 6 refs.
Coutermarsh, B.A.
36-3924
MOISTURE DETECTION, ROOFS, CELLULAR PLASTICS, THERMAL INSULATION, THERMAL REGIME, INFRARED PHOTOGRAPHY.

New roofs with cellular plastic insulation and a bituminous built-up membrane were surveyed with a hand-held infrared camera to determine its effectiveness in detecting damp and wet insulation. Wet areas were found and defined with the help of 2-in.-diam. core samples. The results of the tests showed the infrared camera can be useful and effective as an inspection tool within the time constraints of the typical one-year warranty period. The tests also underlined the importance of core samples for verification.

SR 82-08
SNOW-ONE-A; DATA REPORT.
Aitken, G.W., ed, May 1982, 641p., ADB-068 569, For selected papers see 37-1095 through 37-1107.
37-1094
SNOWFALL, SNOWSTORMS, SNOWFLAKES, ELECTROMAGNETIC PROPERTIES, METEOROLOGICAL DATA, WAVE PROPAGATION, MILITARY OPERATION, VISIBILITY.

This report contains the data obtained during the SNOW-ONE-A Field Experiment. All of the data suitable for presentation in this format are included with the exception of the results from a very few measurement programs whose data could not be provided in time. The report includes meteorological measurements made by CRREL and ASL; snow characterization data from CRREL, AFGL and ASL, OptiMetrics, NRL, AFGL and Photometrics; millimeter wavelength propagation measurements made by BRL; and target/-background data from Optimetrics. The SNOW-ONE-A Field Experiment was the second in a planned series conducted by the Cold Regions Research and Engineering Laboratory for the Directorate of Research and Development of the U.S. Army Corps of Engineers. It was conducted at CEATC, Jericho, Vermont from 30 Nov. 1981 to 23 Feb. 1982.

SR 82-09
CRREL 2-INCH FRAZIL ICE SAMPLER.
Rand, J.H., May 1982, 8p.
36-3744
FRAZIL ICE, SAMPLERS, ANTARCTICA—WEDDELL SEA.

The CRREL 2-inch frazil ice sampler is a tubular device for obtaining undisturbed samples of frazil ice from beneath a floating ice cover. It fits through a 2 1/2 in.-diameter hole drilled in the ice. A liquid-tight seal at the bottom of the sampler prevents the loss of frazil ice and/or water from the tube while the unit is being raised. The sampler was used for the first time in the floes in the Weddell Sea, Antarctica in austral summer, 1980-1981. (Auth. mod.)

SR 82-10
EVALUATING THE HEAT PUMP ALTERNATIVE FOR HEATING ENCLOSED WASTEWATER TREATMENT FACILITIES IN COLD REGIONS.
Martel, C.J., et al, May 1982, 23p., ADA-116 385, 11 refs.
Phetteplace, G.E.
39-1259
HEAT RECOVERY, WASTE TREATMENT, WATER TREATMENT, PUMPS, COST ANALYSIS.

This report presents a five-step procedure for evaluating the technical and economic feasibility of using heat pumps to recover heat from treatment plant effluent. The procedure is meant to be used at the facility planning level by engineers who are unfamiliar with this technology. An example of the use of the procedure and general design information are provided. Also, the report reviews the operational experience with heat pumps at wastewater plants located in Fairbanks, Alaska, Madison, Wisconsin, and Wilton, Maine.

SR 82-11
SNOWPACK PROFILE ANALYSIS USING EXTRACTED THIN SECTIONS.
Harrison, W.L., May 1982, 15p., ADA-117 839, 3 refs.
36-3925
SNOW SURVEY TOOLS, PROFILES, EQUIPMENT.

A method is presented for obtaining snow profiles for analysis. The method and required equipment replace former methods such as the "roaring bonfire" technique and the use of dyes.

SR 82-12
EFFECTS OF INUNDATION ON SIX VARIETIES OF TURFGRASS.
Erbisch, F.H., et al, May 1982, 25p., ADA-117 838, Refs. p.17-25.
Stark, K.L.
36-4002
GRASSES, GROWTH, FLOODING, DAMAGE, PLANT PHYSIOLOGY, TESTS.

Six cold-adapted grasses were given ten-day dark and inundation stress treatments. Nugget Kentucky bluegrass grown in soil or gravel exhibited the best survival. Sydsport bluegrass did well in gravel. Meadow foxtail and manchar brome survived the treatments when grown in silt soil, but did not when grown on gravel soil. Rhizomes were regenerated by most of the grasses. Root transverse sections did not show any stress-related damage, but leaf sections did. The damage in the sections paralleled that observed macroscopically. Electrophoretic analysis for the peroxidase enzyme complex showed significant banding pattern differences before external damage was visible. This technique may prove to be a diagnostic tool for determining stress damage. Seedlings of all grasses except sydsport bluegrass survived a 15-day inundation.

SR 82-13

IMPROVING ELECTRIC GROUNDING IN FROZEN MATERIALS.

Delaney, A.J., et al, June 1982, 12p., ADA-117 873, 14 refs.

Sellmann, P.V., Arcone, S.A.

37-51

PERMAFROST PHYSICS, ELECTRICAL GROUNDING, ELECTRICAL RESISTIVITY, SALINE SOILS, GRAIN SIZE, ELECTRIC CHARGE, FROZEN GROUND PHYSICS, TESTS.

This study shows that resistance to ground of a simple vertical electrode in frozen fine-grained soil can be lowered significantly by placing it in a hole backfilled with a conductive soil-salt mixture. These tests were performed near Fairbanks, Alaska, in perennially frozen silt. Three electrodes were installed in holes created by detonating standard military shaped charges placed at the ground surface. The backfill contained varying amounts of salt. Measurement of resistance to ground of each electrode was made seasonally. The resistance to ground was lowered by an order of magnitude by the addition of a water-saturated salt-soil backfill, Improvement persisted six months after the backfill was placed *and allowed to freeze. The degree of improvement provided* by this technique will be a function of grain size and permeability of the surrounding soil.

SR 82-14

EVALUATION OF A SIMPLE MODEL FOR PREDICTING PHOSPHORUS REMOVAL BY SOILS DURING LAND TREATMENT OF WASTEWATER.

Ryden, J.C., et al, June 1982, 12p., ADA-117 848, 35 refs.

Syers, J.K., Iskandar, I.K.

36-4092

WASTE TREATMENT, WATER TREATMENT, *SOIL CHEMISTRY, FORECASTING, LAND* RECLAMATION, MATHEMATICAL MODELS.

This report evaluates a simple P balance model to predict site longevity with respect to P removal during land treatment of wastewater. The model is based on measured inputs and outputs of P at the treatment site and on an estimate of the P storage capacity of the soil profile. Sorption of P by three soils used for land treatment conformed to the P sorption model based on a generalized isotherm. Laboratory sorption tests were used to predict P storage capacity of the soil profiles at a solution P concentration equivalent to that in the effluent applied to the soil. For two soil profiles the P balance model predicted site longevities of approximately 50 and 210 years. The existing depth of P enrichment in these profiles predicted from the model agreed closely with measurements of P enrichment based on amounts of NaOH-extractable P and on measured soil solution P concentrations.

SR 82-15

LIMNOLOGICAL INVESTIGATIONS: LAKE KOOCANUSA, MONTANA. PART 4: FACTORS CONTROLLING PRIMARY PRODUCTIVITY.

Woods, P.F., et al, June 1982, 106p., ADA-119 328, Refs. p.54-63.

Falter, C.M.

37-173

BIOMASS, RESERVOIRS, LIMNOLOGY, DAMS, PHOTOSYNTHESIS, LAKE WATER, WATER TEMPERATURE.

Postimpoundment loadings of total nitrogen and total phosphorus delivered to Lake Koocanusa by the principal inflowing stream, the Kootenai River, were predicted to be large enough to cause eutrophication of the lake; however, measured annual primary productivity for 1972 through 1075 was relatively low, and characteristic of oligotrophic values because phytoplankton photosynthesis was suppressed by physical limnological factors. The predominant flood-control function of the reservoir necessitates substantial reductions in volume during the autumn and winter. These large-scale water movements weakened the thermal structure of the reservoir.

SR 82-17

[PROCEEDINGS].

Snow Symposium, 1st, Hanover, NH, August 1981, June 1982, 324p., ADB-091 442, Refs. passim. For individual papers see 40-1928 through 40-1946.

40-1927

SNOW SURVEYS, SNOWFALL, BLOWING SNOW, MILITARY OPERATION, SNOW OPTICS, SNOW ACOUSTICS, TRANSMISSION, MEETINGS, SCATTERING, SNOW WATER EQUIVALENT, INFRARED RADIATION, VISIBILITY.

SR 82-18

PROCEEDINGS OF A WORKSHOP ON THE PROPERTIES OF SNOW, 8-10 APRIL 1981, SNOWBIRD, UTAH.

Brown, R.L., ed, 1982, 135p., ADA-120 517, Refs. passim. For individual papers see 36-2530 through 36-2535 and 39-1718. Includes committee chairmen's reports.

Colbeck, S.C., ed, Yong, R.N., ed.

39-1717

SNOW PHYSICS, SNOW SURVEYS, METAMORPHISM (SNOW), SNOW MECHANICS, SNOW ACCUMULATION, SNOW OPTICS, SNOW ELECTRICAL PROPERTIES.

SR 82-19

CHEMICAL OBSCURANT TESTS DURING WINTER; ENVIRONMENTAL FATE.

Cragin, J.H., Aug. 1982, 9p., ADB-068 594, 3 refs.

37-733

AEROSOLS, SNOW COMPOSITION, SNOW SURFACE, AIR POLLUTION, CHEMICAL PROPERTIES, SMOKE GENERATORS.

Concentrations of orthophosphate, IR1 and IR2 obscurants were measured in surface snow samples after a winter test of white phosphorus (WP) smoke and the two infrared screeners. Sample concentrations of IR1 and IR2 decreased exponentially downwind from the smoke release point. Orthophosphate concentrations were all lower than the analytical detection limit of 0.15 mg/L. Quantities of smoke released pose no hazard to the public or environment. Snow was found to provide a clean non-contaminating surface upon which to collect the deposited aerosol.

SR 82-20

BIBLIOGRAPHY OF LITERATURE ON CHINA'S GLACIERS AND PERMAFROST. PART 1: 1938-1979.

Shen, J., ed, Sep. 1982, 44p., ADA-122 399.

Zhang, X., ed.

37-2371

GLACIER SURVEYS, PERMAFROST, GLACIOLOGY, SNOW SURVEYS, ICE SURVEYS, BIBLIOGRAPHIES, AVALANCHES, MUDFLOWS, REMOTE SENSING, MAPPING, ISOPTOPE ANALYSIS, CHINA.

This report is a translation of a book received by USACRREL as part of its cooperative program with the Institute of Glaciology and Cryopedology, Academia Sinica, People's Republic of China. The bibliography covers the following topics: glaciers by geographic regions, applied glaciology including snow, avalanches, and river ice, permafrost (cryopedology), mud flows, and survey techniques including mapping, remote sensing, and isotope analyses. A list of Chinese journals is included.

SR 82-21

LIMNOLOGICAL INVESTIGATIONS: LAKE KOOCANUSA, MONTANA. PART 1: PRE-IMPOUNDMENT STUDY, 1967-1972.

Bonde, T.J.H., et al, Oct. 1982, 184p., ADA-119 632, Refs. p.76-78.

Bush, R.M.

39-1260

LIMNOLOGY, LAKE WATER, DAMS, WATER POLLUTION, RESERVOIRS, NUTRIENT CYCLE, UNITED STATES—MONTANA—KOOCANUSA, LAKE.

This report documents the effects of the construction of Libby Dam upon the water quality of the United States portion of the Kootenai River during the pre-impoundment phase of a long-term water quality study. Water quality problems during dam construction appeared to be restricted to short-term increases in suspended sediment and turbidity which suppressed the aquatic insect population in the river downstream. Abnormally high background concentrations and abrupt chemical changes in water quality during the *course of the study were attributed to industrial discharges* from a fertilizer plant and mining operation located on an upstream tributary to the river. Nutrient loadings of nitrogen and phosphorus were found to be of sufficient magnitude to predict the development of eutrophic conditions following impoundment suggesting that efforts in controlling nutrient point sources be continued.

SR 82-22

SUPPRESSION OF ICE FOG FROM THE FORT WAINWRIGHT, ALASKA, COOLING POND.

Walker, K.E., et al, Oct. 1982, 34p., ADA-123 069, 28 refs.

Brunner, W.

39-1729

ICE FOG, VISIBILITY, COUNTERMEASURES, PONDS, COOLING SYSTEMS, AIR TEMPERATURE, VEHICLES, ACCIDENTS.

Ice fog near the Ft. Wainwright cooling pond creates a visibility hazard. Observations show a substantial reduction in visibility along both private and public roadways in the path of the cooling pond's ice fog plume. This reduction in visibility increases as the ambient air temperature decreases. Visibility was less than 215 m (700 ft) on the Richardson Highway on the average of 8 days for each of the 3 data years. Data collected during the winters of 1979-80, 1980-81 and 1981-82 statistically show that use of a monomolecular film evaporation suppressant, hexadecanol, on the pond to reduce ice fog is ineffective. There is an immediate need for a driver warning system when visibility is affected by the ice fog.

SR 82-23

LIMNOLOGICAL INVESTIGATIONS: LAKE KOOCANUSA, MONTANA. PART 3: BASIC DATA, POST-IMPOUNDMENT, 1972-1978.

Storm, P.C., et al, Nov. 1982, 597p., ADA-124 454, 8 refs.

Bonde, T.J.H., Bush, R.M., Helms, J.W.

38-4080

LIMNOLOGY, LAKE WATER, WATER CHEMISTRY, WATER POLLUTION, RESERVOIRS, RIVERS, STATISTICAL ANALYSIS, WASTE DISPOSAL, WATER TREATMENT, WATER TEMPERATURE, UNITED STATES—MONTANA—KOOCANUSA, LAKE.

Study of Lake Koocanusa, Montana (the reservoir formed by impoundment of the Kootenai River by Libby Dam in 1972), was undertaken in 1972 as a continuation of pre-impoundment studies of the Kootenai River underway since 1967. This report presents the water quality-limnological data compiled by the Corps of Engineers from 1972 through 1978. Additional information was provided by the British Columbia Ministry of Environment, Waste Management Branch, and the Water Survey of Canada. The data are presented in tabular form. No analyses are included.

SR 82-24

ENERGY CONSERVATION AT THE WEST DOVER, VERMONT, WATER POLLUTION CONTROL FACILITY.

Martel, C.J., et al, Nov. 1982, 18p., ADA-123 170, 4 refs.

Sargent, B.C, Bronson, W.A.

37-2372

WATER TREATMENT, WATER POLLUTION, SEWAGE TREATMENT, WASTE TREATMENT, ENVIRONENTAL PROTECTION, COST ANALYSIS.

An energy audit was conducted at the West Dover, Vermont, water pollution control facility. The audit revealed that aeration, not pumping to the land treatment site, was the largest energy consumer. As a result of the audit, five Energy Conservation Opportunities (EOC) were evaluated. Three of the ECOs were recommended for implementation; these could result in annual savings of more that $6000. The remaining two ECOs were not recommended because of a large capital investment required and a long payback period.

SR 82-25

METHOD FOR MEASURING ENRICHED LEVELS OF DEUTERIUM IN SOIL WATER.

Oliphant, J.L., et al, Nov. 1982, 12p., ADA-123 070, 10 refs.

Jenkins, T.F., Tice, A.R.

38-4039

SOIL WATER, HYDROGEN, ISOTOPES, HEAVY WATER, SPECTROSCOPY, ACCURACY.

This report describes procedures for analyzing hydrogen isotope ratios. Hydrogen is separated from liquid water or soil water by reacting the water with heated uranium. An isotope-ratio mass spectrometer determines the atom % deuterium in the hydrogen to a precision of 0.0075. Ways of upgrading the mass spectrometer to obtain better precision are also discussed.

SR 82-26

USER'S INDEX TO CRREL LAND TREATMENT COMPUTER PROGRAMS AND DATA FILES.

Berggren, P.A., et al, Nov. 1982, 65p., ADA-123 172, Refs. p.56-65.

Iskandar, I.K.

37-2373

WASTE TREATMENT, WATER TREATMENT, LAND RECLAMATION, COMPTUER PROGRAMS.

This user's index is a directory for the computer programs and data files developed at CRREL on land treatment of wastewater. Two computers are used, a Prime 400 located at CRREL and the Dartmouth Time Sharing System (DTSS) located at Dartmouth College, Hanover, New Hampshire. The objective of this directory is to allow users to locate and use or request desired programs of data files, to maintain a permanent record of programs and data files developed under the land treatment program, and to assist in technology transfer. Appendix A contains a list of published papers and technical reports related to the computer programs and the data files. The program or file of concern is listed at the end of each citation.

SR 82-27
PILOT-SCALE EVALUATION OF THE NUTRIENT FILM TECHNIQUE FOR WASTEWATER TREATMENT.
Bouzoun, J.R., et al, Nov. 1982, 34p., ADA-123 429, 12 refs.
Diener, C.J., Butler, P.L.
38-4383
WASTE TREATMENT, WATER TREATMENT, CHEMISTRY, NUTRIENT CYCLE, PLANT PHYSIOLOGY, WATER RETENTION.

An experiment was conducted to determine the feasibility of using several plant species in a pilot-scale nutrient film technique (NFT) installation to further treat primary-treated effluent. The reduction of biochemical oxygen demand, total suspended solids, and nitrogen and phosphorus concentrations by the NFT is discussed. Tracer studies showed that the hydraulic retention time of the wastewater in the NFT trays was inversely related to the wastewater application rate, and that for a given flow, plants with fine root systems (such as reed canarygrass) had a much longer detention time than plants with coarse tuberous rhizomes (such as cattails). The BOD reduction could be described using the plug-flow reactor model with first-order kinetics.

SR 82-28
PHYSICAL PROPERTIES OF THE ICE COVER OF THE GREENLAND SEA.
Weeks, W.F., Nov. 1982, 27p., ADA-123 712, 3 refs.
37-2374
ICE PHYSICS, SEA ICE, ICE STRUCTURE, ICE COMPOSITION, ICE MECHANICS, ICE FRICTION, ICE ADHESION, ICE ELECTRICAL PROPERTIES, ICE THERMAL PROPERTIES, FAST ICE, PACK ICE, GREENLAND SEA.

There is very little information available on the physical properties of the ice cover of the Greenland Sea. This paper reviews what is known about the different types of ice that are believed to occur in this area. It also discusses how the internal structure and composition of these ice masses may differ from those of the more extensively studied ice of the Beaufort Sea and identifies gaps in the present knowledge of the properties of such ice masses (regardless of places of origin). Finally a strategy is outlined for efficiently studying the properties of the ice in the Greenland Sea by combining structural and compositional characterization with limited property determinations.

SR 82-30
BASELINE WATER QUALITY MEASUREMENTS AT SIX CORPS OF ENGINEERS RESERVOIRS, SUMMER 1981.
Parker, L.V., et al, Dec. 1982, 55p., ADA-125 440, 13 refs.
Jenkins, T.F., Brockett, B.E., Butler, P.L., Cragin, J.H., Govoni, J.W., Keller, D.B.
37-3495
RESERVOIRS, WATER CHEMISTRY, WATER POLLUTION, CHEMICAL ANALYSIS, WATER TEMPERATURE, SUSPENDED SEDIMENTS.

Water quality information was collected at six reservoirs of the New England Division, U.S. Army Corps of Engineers, during the summer and fall of 1981. The reservoirs tested included Ball Mountain in Jamaica, Vermont, Everett and Hopkinton-Elm Brook in Hopkinton, New Hampshire, North Hartland in North Hartland, Vermont, Stoughton Pond and North Springfield in North Springfield, Vermont, and Townshend in Townshend, Vermont. Field measurements included temperature, pH, conductivity, dissolved oxygen, depth, and the point of visual extinction. Laboratory analyses included determination of total suspended matter, turbidity, alkalinity, ammonium, nitrate, orthophosphate, total phosphorus, total nitrogen, total organic carbon, heavy metals (Zn, Pb, Cd and Cr), fecal coliforms, and chlorophyll a.

SR 82-31
RESERVOIR BANK EROSION CAUSED AND INFLUENCED BY ICE COVER.
Gatto, L.W., Dec. 1982, 26p., ADA-124 508, Refs. p.20-26.
38-4040
BANKS (WATERWAYS), SOIL EROSION, ICE EROSION, RESERVOIRS, ICE COVER EFFECT, EROSION, WATER LEVEL, BEACHES.

The purpose of this study was to evaluate the importance of reservoir bank erosion caused by an ice cover. The evaluation is based on a literature review and on inferences made from field observations and experience. Very little is known about the amount of reservoir bank erosion caused by the actions of an ice cover, although considerable information is available on the processes of ice-related erosion along the shorelines or beaches of oceans, rivers or lakes. The importance of ice-related erosion along a reservoir bank seems to be determined primarily by water level. If the reservoir water level is high enough for ice to act directly on the bank face, the amount of erosion caused by ice could be substantial. If the water level is below the bank, ice would have no direct effect on it. However, ice could indirectly increase bank instability by disrupting and eroding nearshore and beach zones, which could lead to bank erosion.

SR 82-32
DEVELOPING A WATER WELL FOR THE ICE BACKFILLING OF DYE-2.
Rand, J.H., Dec. 1982, 19p., ADA-125 503, 11 refs.
39-1730
WATER SUPPLY, ICE MELTING, WELLS, LOGISTICS, GREENLAND.

One proposal to extend the useful life of DEW Line Ice Cap Station DYE-2 is to backfill the lower 50 feet of the truss enclosure with ice. This report discusses a method by which 2.8 million gallons of water would be collected and stored by melting ice. Also included is a description of required components, their costs and the logistical requirements to establish such a system.

SR 82-33
INFRARED INSPECTION OF NEW ROOFS.
Korhonen, C., Dec. 1982, 14p., ADA-125 502, 9 refs.
37-2788
ROOFS, MOISTURE DETECTION, INFRARED PHOTOGRAPHY, THERMAL INSULATION, BUILDINGS.

The feasibility of using infrared cameras to detect wet insulation during the typical 1-year warranty period for new Army roofs was studied. Both the ability to gain moisture and the manner of wetting of insulations were of major concern. Although some insulations take on moisture much slower that others, 8 to 10 months usually is ample time for most insulations to absorb enough moisture to be detectable by an infrared camera. However, the early signs of this moisture as seen with the infrared camera differ with insulation type. Basically, boards of slower-wetting cullular plastic insulations initially wet at their perimeters, whereas highly absorbent fibrous insulations tend to wet more or less uniformly. An infrared camera is well suited for finding the typically small and sometimes irregularly shaped wet areas on a new roof. A specification incorporating this technology should be now tested.

SR 83-01
USING THE DWOPER ROUTING MODEL TO SIMULATE RIVER FLOWS WITH ICE.
Daly, S.F., et al, Jan. 1983, 19p., ADA-125 439, 10 refs.
Ashton, G.D.
37-2487
RIVER FLOW, RIVER ICE, ICE COVER EFFECT, ICEBOUND RIVERS, FLOODS, FLOW RATE, MATHEMATICAL MODELS.

The flow routing model of the National Weather Service entitled DWOPER (Dynamic Wave Operational Forecast Program) is examined with regard to the modifications required to include the effect of river ice on the flow variables of water level and discharge. Difficulties in modeling the ice effects are described. Example model output is presented showing the transient effects introduced by imposition of removal of the ice cover from and otherwise uncovered flow.

SR 83-03
CRREL INSTRUMENTED VEHICLE: HARDWARE AND SOFTWARE.
Blaisdell, G.L., Jan. 1983, 75p., ADA-128 713.
38-4041
TIRES, VEHICLES, LOADS (FORCES), SURFACE PROPERTIES, TESTS, COMPUTER PROGRAMS, MEASURING INSTRUMENTS, MAINTENANCE, VELOCITY.

This report gives a detailed description of the CRREL Instrumented Vehicle (CIV). The CIV is equipped with instrumentation to measure three mutually perpendicular forces acting at the interface between the front tires and any surface material. In addition, accurate wheel and vehicle speeds and rear axle torque are measured. The vehicle is equipped for front-wheel, rear-wheel or four-wheel drive. A dual brake system allows front-, rear- or four-wheel braking. A minicomputer-based data acquisition system is installed in the vehicle to control data gathering and to process the data. The software for data acquisition and manipulation and the interfacing techniques required are described.

SR 83-04
SNOW SYMPOSIUM 2; U.S. ARMY COLD REGIONS RESEARCH AND ENGINEERING LABORATORY, HANOVER, NEW HAMPSHIRE, AUGUST 1982, VOL.1.
Snow Symposium, 2nd, Hanover, NH, August 1982, Mar. 1983, 295p., ADB-073 046, Refs. passim. For individual papers see 38-4305 through 38-4325.
38-4304
SNOW PHYSICS, SNOW CRYSTAL STRUCTURE, SNOWFALL, BLOWING SNOW, SNOW OPTICS, INFRARED RADIATION, LIGHT TRANSMISSION, LIGHT SCATTERING, VISIBILITY, MODELS, MEETINGS.

SR 83-05
FROZEN SOIL CHARACTERISTICS THAT AFFECT LAND MINE FUNCTIONING.
Richmond, P.W., Apr. 1983, 18p., ADA-144 308, 10 refs.
39-96
MILITARY OPERATION, FROZEN GROUND MECHANICS, EXPLOSION EFFECTS, LOADS (FORCES), MINES (ORDNANCE), FREEZE THAW CYCLES, STRESSES, FROZEN GROUND TEMPERATURE, TENSILE PROPERTIES, WATER CONTENT.

This report discusses the results of an experiment to determine the effect of five factors on the load transferred through frozen soil to a buried land mine. The five variables examined were load, temperature, number of freeze-thaw cycles, soil, and water content. Analysis of a half-fraction factorial experiment shows that no one variable can be used as a predictor of mine functioning performance.

SR 83-06
OPTIMIZATION MODEL FOR LAND TREATMENT PLANNING, DESIGN AND OPERATION. PART 1. BACKGROUND AND LITERATURE REVIEW.
Baron, J.A., et al, Apr. 1983, 35p., ADA-134 554, Refs. p.31-35.
Lynch, D.R., Iskandar, I.K.
38-882
LAND RECLAMATION, WASTE TREATMENT, WATER TREATMENT, MODELS, DESIGN, NUTRIENT CYCLE, SEASONAL VARIATIONS, AGRICULTURE.

The material presented in Part I is intended to provide insight into the possible land treatment planning objectives, the status of land treatment research and implementation, the renovative processes that occur in the various components of these systems, and the potential for optimizing the configuration of these components. The structure and application of nine models, which include methods to optimize the regional planning, design and operation of slow-rate land treatment systems, are briefly discussed. General comments follow on the overall status of research in land treatment modeling and design and directions for future work.

SR 83-07
OPTIMIZATION MODEL FOR LAND TREATMENT PLANNING, DESIGN AND OPERATION. PART 2. CASE STUDY.
Baron, J.A., et al, Apr. 1983, 30p., ADA-134 513, 14 refs.
Lynch, D.R., Iskandar, I.K.
38-883
WASTE TREATMENT, WATER TREATMENT, LAND RECLAMATION, DESIGN, MODELS, NUTRIENT CYCLE, AGRICULTURE.

A procedure to evaluate design and operating options for slow-rate land treatment systems is demonstrated. The nonlinear optimization model LTMOD is used to generate optimal monthly operating regimes (effluent application patterns) and to define optimal design configurations (combinations of storage capacity and irrigation area). The model is applied to a hypothetical slow-rate land treatment system in a cool, humid area with a forage crop, where the operation and design of the system is constrained by the potential for nitrogen renovation in the storage facility and in the soil-crop system. The cost properties over the range of optimal design alternatives are examined to deduce some general cost characteristics of slow-rate systems ranging from 0.5 to 10 mgd.

SR 83-08
OPTIMIZATION MODEL FOR LAND TREATMENT PLANNING, DESIGN AND OPERATION. PART 3. MODEL DESCRIPTION AND USER'S GUIDE.
Baron, J.A., et al, Apr. 1983, 38p., ADA-134 461, 4 refs.
Lynch, D.R.
38-884
WASTE TREATMENT, LAND RECLAMATION, WATER TREATMENT, MODELS, DESIGN.

A nonlinear optimization model applicable to slow-rate land treatment systems in cool, humid regions is described. The model prescribes optimal design variables as well as an operating schedule for a facility comprising a storage lagoon with bypass and a single-crop irrigation system. The optimization is achieved by use of generalized, commercially available software that embodies the reduced gradient method. The model equations are presented. The computational structure as implemented on the CRREL Prime System is described, with instructions for use. A sample problem illustrates model application, and a program listing is appended.

SR 83-09
CORPS OF ENGINEERS LAND TREATMENT OF WASTEWATER RESEARCH PROGRAM: AN ANNOTATED BIBLIOGRAPHY.
Parker, L.V., et al, Apr. 1983, 82p., ADA-130 136.
Berggren, P.A., Iskandar, I.K., Irwin, D., McDade, C., Hardenberg, M.
38-4042
WASTE TREATMENT, WATER TREATMENT, SANITARY ENGINEERING, LAND RECLAMATION, BIBLIOGRAPHIES.

This bibliography contains publications of research funded in whole or in part by the Corps of Engineers Land Treatment Research Program, conducted from January 1972 to May 1982. The program was officially complete in October 1980. Six types of publications are included: 1) publications in open literature (which may include papers in journals, chapters in books and books), 2) technical reports, 3) engineer technical letters, 4) draft translations (mainly from Russian), 5) theses and dissertations (M.S., Ph.D.), and 6) presentations at scientific conferences.

SR 83-10
SYNOPTIC METEOROLOGY DURING THE SNOW-ONE-A FIELD EXPERIMENT.
Bilello, M.A., May 1983, 80p., ADA-134 888, 8 refs.
38-885
SNOWFALL, STORMS, FREEZING, SYNOPTIC METEOROLOGY, PRECIPITATION (METEOROLOGY), METEOROLOGICAL DATA.

The daily atmospheric systems and weather fronts that traversed the northeastern United States during the SNOW-ONE-A Field Experiment from 30 November to 20 December 1981 and from 3 January to 10 February 1982 are summarized. This experiment is the second of a series of winter measurements of the influence of atmospheric obscurants on electro-optical system performance. The analysis of the large-scale synoptic weather patterns that developed during the field test period constitutes a critical component of the research program. Precipitation in northern Vermont during SNOW-ONE-A was near normal for the region. Numerous separate snowfall events, including some with substantial amounts of snow, were recorded during the experiment period. Almost all of the storms that produced more than 6 cm of snow resulted from coastal cyclogenesis or developing waves that deepened as they moved north or northeastward along the Atlantic coastline. The majority of the other events with lighter amounts of freezing precipitation were caused by less intense storm systems, troughs, or fronts that traversed the region from the west or northwest and often moved quite rapidly.

SR 83-11
EFFECT OF VESSEL SIZE ON SHORELINE AND SHORE STRUCTURE DAMAGE ALONG THE GREAT LAKES CONNECTING CHANNELS.
Wuebben, J.L., May 1983, 62p., ADA-134 887, 13 refs.
40-4677
SHORES, CHANNELS (WATERWAYS), ICE LOADS, SHIPS, STRUCTURES, DAMAGE, VELOCITY, GREAT LAKES.

In conjunction with the Great Lakes connecting channels and harbors study, this report examines the potential damage to the shore and shore structures due to an increase in vessel size. The areas considered in this report are the United States shorelines along the St. Marys, St. Clair and Detroit rivers. The potential for shoreline or shore structure damage due to an increase in vessel size was reviewed on both a conceptual and site-specific basis. Ship-induced waves were ruled out as a damage mechanism since the analysis showed that the contemplated increases in vessel size would not significantly affect wave heights in the nearshore zone. Propeller wash was discounted for similar reasons. Ship-induced drawndown was determined to be the major potential damage mechanism. While larger ships potentially produce more damage, this potential is significant only in severely restricted channel sections for the size increase considered here. By far the most significant factor in ship-related damage potential is vessel speed. In almost all areas the effect of an increase in vessel size could be eliminated by a reduction in vessel speed of 1-2 mph.

SR 83-12
MIZEX—A PROGRAM FOR MESOSCALE AIR-ICE-OCEAN INTERACTION EXPERIMENTS IN ARCTIC MARGINAL ICE ZONES. 2. A SCIENCE PLAN FOR A SUMMER MARGINAL ICE ZONE EXPERIMENT IN THE FRAM STRAIT/GREENLAND SEA: 1984.
Johannessen, O.M., ed, May 1983, 47p., ADA-134 872, Refs. p.19-21.
Hibler, W.D., III, ed, Wadhams, P., ed, Campbell, W.J., ed, Hasselmann, K., ed, Dyer, I., ed, Dunbar, M., ed.
38-876
ICE WATER INTERFACE, ICE AIR INTERFACE, ICE NAVIGATION, ICE EDGE, RESEARCH PROJECTS, GREENLAND SEA.

SR 83-13
REPORTS OF THE U.S.-U.S.S.R. WEDDELL POLYNYA EXPEDITION, OCTOBER-NOVEMBER 1981, VOLUME 6: UPPER-AIR DATA.
Andreas, E.L., May 1983, 288p., ADA-134 871.
38-4498
MARINE METEOROLOGY, SOUNDING, METEOROLOGICAL INSTRUMENTS, ANTARCTICA—WEDDELL SEA.

This report summarizes the most extensive set of upper-air data ever collected over Antarctic sea ice in winter, the data obtained using radiosondes during the U.S.-U.S.S.R. Weddell Polynya Expedition. The report includes a description of the two radiosonde systems used, a chronological listing of all 110 soundings made during the expedition, a discussion of measured and derived quantities, listings of all of the sounding data, and plots to 5 km of the potential temperature profile from each sounding.

SR 83-14
REPORTS OF THE U.S.-U.S.S.R. WEDDELL POLYNYA EXPEDITION, OCTOBER-NOVEMBER 1981 VOLUME 7: SURFACE-LEVEL METEOROLOGICAL DATA.
Andreas, E.L., et al, May 1983, 32p., ADA-134 476, 11 refs.
Makshtas, A.P.
38-867
METEOROLOGICAL DATA, SEA ICE, ICE TEMPERATURE, WIND VELOCITY, AIR TEMPERATURE, HUMIDITY, SOLAR RADIATION, ANTARCTICA—WEDDELL SEA.

This report summarizes a comprehensive set of surface-level meteorological data collected on the *Mikhail Somov* over sea ice in the southern ocean during the U.S.-U.S.S.R. Weddell Polynya Expedition in October and November of 1981. The data assembled here comprise three distinct sets of measurements: the standard meteorological observations at 3-hour intervals for 41 consecutive days, radiation and ice-surface temperature measurements every hour for 23 days while the *Somov* was within the Antarctic ice pack, and 23 sets of atmospheric surface-layer profiles of velocity, temperature and humidity for various sea-ice conditions. (Auth.)

SR 83-15
SHORELINE EROSION AND SHORE STRUCTURE DAMAGE ON THE ST. MARYS RIVER.
Wuebben, J.L., May 1983, 36p., ADA-134 863, 4 refs.
38-886
SHORELINE MODIFICATION, SHORE EROSION, FAST ICE, SEDIMENT TRANSPORT, STRUCTURES, DAMAGE, ICE NAVIGATION, ICE FLOES, PIERS.

From 1961 to 1970 navigation on the St. Marys River closed for the winter from mid-December to mid-April. Subsequent extension of the navigation season to include the winter months resulted in complaints of shoreline and dock damage along the navigation channels. Studies were initiated to examine the potential for navigation-caused damage, but information on damage during a navigation-free winter was lacking. Since limited navigation was planned during the 1979-80 winter, the St. Marys River System could be examined under relatively undisturbed conditions. The report examines potential navigation-related damage mechanisms and presents data from the closed navigation season. The results are compared with information collected during previous periods with winter navigation.

SR 83-16
SNOW-ONE-B DATA REPORT.
Bates, R.E., ed, June 1983, 284p., ADB-088 224, Refs. passim. For individual papers see 39-1952 through 39-1961. For SNOW-ONE-A—preliminary data report see 37-1094 (SR 82-8).
Bowen, S.L., ed.
39-1951
SNOWFLAKES, WAVE PROPAGATION, MILITARY OPERATION, SNOWFALL, SNOWSTORMS, METEOROLOGICAL DATA, VISIBILITY, ELECTROMAGNETIC PROPERTIES, OPTICAL PROPERTIES, TRANSMISSION.

This is the third in a series of data reports on the SNOW field experiments of the U.S. Army Corps of Engineers Winter Battlefield Obscuration Research Program. It contains data obtained by the U.S. Army Cold Regions Research and Engineering Laboratory and other agencies during the SNOW-ONE-B field experiment at Camp Grayling, Michigan, between 30 November and 17 December 1982. Included are data on meteorology, atmospheric turbulence, visible and IR transmission, snow characterization, millimeter wavelength radar propagation, transmittance through falling and blowing snow, the lidar system, the SMART system, and preliminary smoke trials with snow as a contrast background.

SR 83-17
PROCEEDINGS OF THE FIRST INTERNATIONAL WORKSHOP ON ATMOSPHERIC ICING OF STRUCTURES, 1-3 JUNE 1982, HANOVER, NEW HAMPSHIRE.
Minsk, L.D., ed, June 1983, 366p., ADA-131 869, Refs. passim. For individual papers see 38-424 through 38-463.
38-423
ICING, STRUCTURES, ICE LOADS, SNOW LOADS, ICE ACCRETION, SNOW ACCUMULATION, TRANSMISSION LINES, POWER LINE ICING, MEETINGS, ICE REMOVAL, ICE PREVENTION.

SR 83-18
EFFECT OF UNCONFINED LOADING ON THE UNFROZEN WATER CONTENT OF MANCHESTER SILT.
Oliphant, J.L., et al, June 1983, 17p., ADA-131 851, 13 refs.
Tice, A.R., Berg, R.
39-1370
FROZEN GROUND STRENGTH, LOADS (FORCES), UNFROZEN WATER CONTENT, SOIL WATER, TEMPERATURE MEASUREMENT, NUCLEAR MAGNETIC RESONANCE, THERMODYNAMICS.

Frozen samples of a Manchester silt having various total water contents were subjected to several surcharge loads, and the unfrozen water content was measured with NMR as the temperature was gradually raised. The surcharge pressure had a greater effect on the unfrozen water content than had been predicted using the Clausius-Clapeyron equation. This effect was explained by considering the loaded samples as nonequilibrium systems in which the surcharge pressures were concentrated in the ice phase.

SR 83-19
PREDICTING LAKE ICE DECAY.
Ashton, G.D., June 1983, 4p., ADA-132 012, 4 refs.
38-471
LAKE ICE, ICE DETERIORATION, HEAT TRANSFER, FORECASTING, DEGREE DAYS, ANALYSIS (MATHEMATICS).

A nine-year record of the lake ice decay pattern of Post Pond in Lyme, New Hampshire, is analyzed using a simple algorithm. Quite good correlations between decay rates and thawing degree-days are obtained using heat transfer coefficients on the order of 15-20 W/sq m/deg C.

SR 83-2
REPORTS OF THE U.S.-U.S.S.R. WEDDELL POLYNYA EXPEDITION, OCTOBER-NOVEMBER 1981, VOLUME 5, SEA ICE OBSERVATIONS.
Ackley, S.F., et al, Jan. 1983, 6p. + 59p., ADA-130 140, 4 refs.
Smith, S.J.
39-380
SEA ICE DISTRIBUTION, POLYNYAS, ICE CONDITIONS.

Sea ice conditions are presented in several formats. These include an ice conditions map prepared by the ship's meteorological crew, a narrative ice log supplemented by photographs taken by one of the authors, and daily satellite photographs. These are presented in a format compiling each day's conditions on one or two pages. These observations are being correlated with other satellite-based estimates of ice conditions, and with other oceanographic and meteorological measurements made during the expedition. (Auth.)

SR 83-20
SNOW COVER AND METEOROLOGY AT ALLAGASH, MAINE, 1977-1980.
Bates, R., June 1983, 49p., ADA-132 013, 4 refs.
38-472
SNOW COVER DISTRIBUTION, SNOW SURVEYS, SNOW WATER EQUIVALENT, PRECIPITATION (METEOROLOGY), WEATHER STATIONS, METEOROLOGICAL DATA, UNITED STATES—MAINE—ALLAGASH.

A complete meteorological field station and a snow survey network were set up in the Allagash River Watershed to record baseline conditions prior to construction of the proposed Dickey-Lincoln Dam in the upper St. John River Basin in Allagash, Maine. Nearly three years of daily data (Oct 1977-May 1980) are summarized and compared to long-term climatic conditions for nearby National Weather Service stations. Air temperature values for Allagash are similar to those for the two nearest meteorological stations; water equivalent precipitation amounts and snowfall totals in the Allagash basin are inconsistent with those for nearby meteorological stations.

SR 83-21

EXAMINATION OF A BLISTERED BUILT-UP ROOF: O'NEILL BUILDING, HANSCOM AIR FORCE BASE.

Korhonen, C., et al, June 1983, 12p., ADA-133 042, 2 refs.

Greatorex, A.

38-123

ROOFS, DEFORMATION, COLD WEATHER TESTS, MOISTURE, INFRARED SPECTROSCOPY.

Blisters are a common defect in built-up roofs. In January 1983 we examined a recently constructed built-up roof at Hanscom Air Force Base in Bedford, Massachusetts, to determine the cause of its blisters. We used an infrared scanner, took ten core samples, conducted visual examinations, and cut open three blisters. Our findings show that the membrane is essentially watertight and that the blisters were caused by voids that were built into the roof during construction. Poor workmanship and cold weather are the likely causes of the voids. With proper maintenance reasonable performance can be achieved from this imperfect roof.

SR 83-22

ESTIMATING TRANSIENT HEAT FLOWS AND MEASURING SURFACE TEMPERATURES OF A BUILT-UP ROOF.

Korhonen, C., July 1983, 20p., ADA-133 043, 4 refs.

38-541

HEAT TRANSFER, SURFACE TEMPERATURE, ROOFS, INFRARED EQUIPMENT, THERMAL INSULATION.

Transient heat flow through a multilayered building component can be estimated using the transfer function method presented in the ASHRAE (1977) *Handbook of Fundamentals.* Sol-air temperature is one parameter recommended for use in this method, but surface temperatures were shown to be a reasonable substitute. Although the magnitude of the heat flow as calculated with the transfer function appears to be reasonable, more testing should be carried out to determine its accuracy. An infrared camera can measure roof surface temperatures fairly accurately; the most accurate measurements were made at night.

SR 83-23

AEROSTAT ICING PROBLEMS.

Hanamoto, B., Aug. 1983, 29p., ADA-133 403.

39-874

BALLOONS, ICING, PROTECTIVE COATINGS, ICE PREVENTION, COATINGS.

This report describes laboratory tests to determine the effectiveness of a copolymer coating on a balloon to minimize ice build-up problems when operating in sleet, freezing rain or other ice-forming conditions. Methods for deicing the surface after an ice cover forms are also described. A small-scale balloon was used for the laboratory tests. A full-scale prototype was also partially coated with the copolymer to test its effectiveness as an icing control measure.

SR 83-24

CURRENT PROCEDURES FOR FORECASTING AVIATION ICING.

Tucker, W.B., Aug. 1983, 31p., ADA-136 152, 23 refs.

38-2437

AIRCRAFT ICING, ICE FORECASTING, WEATHER FORECASTING, METEOROLOGICAL FACTORS.

The responsibilities for aircraft icing forecasts in the U.S. lie with the National Weather Service (NWS) for civilian operations and the U.S. Air Forece Air Weather Service (AWS) and Naval Weather Service for military operations. Forecasting technology is based upon empirical rules and techniques that were developed in the 1950s. The AWS is the only forecasting agency which issues explicit numerical icing products to aid the forecaster. These products are also based upon the application of techniques developed long ago. The NWS has no rigorous guidelines for developing icing forecasts, thus individual forecasters adopt their own preferred methods. The tendency is generally to "overforecast," that is, to forecast too large an area of icing for too long a time. A major shortcoming in the ability to produce more accurate forecasts is that atmospheric parameters critical to icing are not routinely observed.

SR 83-25

UNDERSTANDING THE ARCTIC SEA FLOOR FOR ENGINEERING PURPOSES.

National Research Council. Committee on Arctic Seafloor Engineering, 1982, Washington, D.C., National Academy Press, 1982, 141p., ADA-119 773, Refs. p.115-141.

38-787

SUBSEA PERMAFROST, FROZEN GROUND PHYSICS, PERMAFROST PHYSICS, FREEZE THAW CYCLES, OCEAN BOTTOM, ICE CONDITIONS, EROSION, POLAR REGIONS, BOTTOM SEDIMENT, ENGINEERING, EXPLORATION, FROST HEAVE, PETROLEUM INDUSTRY, ICE SCORING, OFFSHORE STRUCTURES, HYDRATES, SEASONAL VARIATIONS, ARCTIC OCEAN.

This report identifies and assesses those arctic seafloor phenomena that influence the design and operation of facilities and platforms for exploring and producing oil, gas, and hard minerals both on and under the sea floor. It also identifies knowledge that is needed of seafloor phenomena and conditions, and, for several areas of major concern, recommends special research. These recommendations are intended to enhance the ability of the engineer and operator to anticipate and avoid problems that may be posed by seafloor and coastal phenomena, and guard against the effects of such events as thaw subsidence and erosion.

SR 83-26

LAND TREATMENT PROCESSES WITHIN CAPDET (COMPUTER-ASSISTED PROCEDURE FOR THE DESIGN AND EVALUATION OF WASTEWATER TREATMENT SYSTEMS).

Merry, C.J., et al, Sep. 1983, 79p., ADA-134 766, Refs. p.70-72.

Corey, M.W., Epps, J.W., Harris, R.W., Cullinane, M.J., Jr.

38-887

LAND RECLAMATION, WASTE TREATMENT, WATER TREATMENT, SEEPAGE, COMPUTERIZED SIMULATION, ANALYSIS (MATHEMATICS).

A summary of the first-, second-, and third-order design steps for the three land treatment unit processes (slow infiltration, rapid infiltration and overland flow) within the CAPDET model is presented. The first-order design, consisting of the basic sanitary engineering processes for slow infiltration, rapid infiltration, and overland flow, is described in terms of the selected procedures and the computer format. The second-order design is a description of the quantities and sizes calculated for each land treatment process. The third-order design is the calculation of the unit process costs by applying prices to the quantities and sizes calculated during the second-order design step.

SR 83-27

REVISED PROCEDURE FOR PAVEMENT DESIGN UNDER SEASONAL FROST CONDITIONS.

Berg, R., et al, Sep. 1983, 129p., ADA-134 480, 7 refs.

Johnson, T.C.

38-888

PAVEMENTS, FROST PROTECTION, FROST ACTION, SOIL STABILIZATION, FROST HEAVE, SEASONAL FREEZE THAW, ROADS, AIRPORTS, THERMAL INSULATION, DESIGN CRITERIA.

This report presents engineering guidance and design criteria for pavements at Army and Air Force facilities in seasonal frost areas. Design methods for controlling surface roughness and loss of subgrade strength during thawing periods are provided. Criteria for using thermal insulating materials and membrane encapsulated soil layers in seasonal frost areas are presented. Six design examples are included.

SR 83-28

SIMPLE BOOM ASSEMBLY FOR THE SHIPBOARD DEPLOYMENT OF AIR-SEA INTERACTION INSTRUMENTS.

Andreas, E.L., et al, Sep. 1983, 14p., ADA-134 256, 21 refs.

Rand, J.H., Ackley, S.F.

38-868

METEOROLOGICAL INSTRUMENTS, MEASURING INSTRUMENTS, SHIPS, BOOMS (EQUIPMENT), ANTARCTICA.

We have developed a simple boom for use in measuring meteorological variables from a ship. The main structural member of the boom, a triangular communications tower with rollers attached along its bottom side, is deployed horizontally from a long, flat deck, such as a helicopter deck, and will support a 100-kg payload at its outboard end. The boom is easy to deploy, requires minimal ship modifications, and provides ready access to the instruments mounted on it. And because it is designed for use with the ship crosswind, oceanographic work can go on at the same time as the air-sea interaction measurements. We describe our use of the boom on the *Mikhail Somov* during a cruise into antarctic sea ice and present some representative measurements made with instruments mounted on it. Theory, experiment, and our data all imply that instruments deployed windward from a rear helicopter deck can reach air undisturbed by the ship. Such an instrument site has clear advantages over the more customary mast, bow, or buoy locations. (Auth.)

SR 83-29

U.S. TUNDRA BIOME PUBLICATION LIST.

Brown, J., et al, Sep. 1983, 29p., ADA-137 441.

Liston, N., Murphy, D., Watts, J.

38-2247

TUNDRA, VEGETATION, ECOSYSTEMS, NUTRIENT CYCLE, BIBLIOGRAPHIES, PLANT PHYSIOLOGY, SOILS, ECOLOGY, CLIMATIC FACTORS, ENVIRONMENTAL IMPACT, GROWTH.

SR 83-30

HISTORICAL BANK RECESSION AT SELECTED SITES ALONG CORPS OF ENGINEERS RESERVOIRS.

Gatto, L.W., et al, Sep. 1983, 103p., ADA-138 030, Refs. p.76-79.

Doe, W.W., III.

39-1371

SOIL EROSION, RESERVOIRS, BANKS (WATERWAYS), ICE COVER EFFECT, FREEZE THAW CYCLES, SHORELINE MODIFICATION, ENVIRONMENTAL IMPACT, WATER WAVES, WIND FACTORS, CLIMATIC FACTORS.

This analysis was done to improve our understanding of the patterns of reservoir bank recession as a preliminary step in a detailed study of reservoir bank erosion processes and environmental impacts. The specific objectives were to observe and document bank characteristics, conditions and changes along reservoirs with eroding banks, to estimate the amounts of historical bank recession, and to analyze its possible causes. Aerial photographs were used to observe the historical bank changes and to estimate bank recession. Site reconnaissance, discussions with Corps personnel, and published reports were used to evaluate possible relationships between the recession and reservoir bank conditions.

SR 83-31

PROCEEDINGS, VOL.1.

Snow Symposium, 3rd, Hanover, NH, Aug. 9-10, 1983, Oct. 1983, 241p., ADB-079 265, Refs. passim.

For individual papers see 38-2119 through 38-2138.

38-2118

SNOW PHYSICS, SNOW CRYSTAL STRUCTURE, SNOW WATER EQUIVALENT, SNOWFALL, HEAT TRANSFER, SNOW SURVEYS, MICROWAVES, REMOTE SENSING, ANALYSIS (MATHEMATICS), MEETINGS.

SR 83-32

MULTIVARIABLE REGRESSION ALGORITHM.

Blaisdell, G.L., et al, Nov. 1983, 41p., ADA-136 630.

Carpenter, T.

38-4043

DATA PROCESSING, ANALYSIS (MATHEMATICS), COMPUTER PROGRAMS, THEORIES.

A BASIC algorithm has been developed that is capable of fitting a user-defined regression equation to a set of data. This best-fit-curve algorithm is unique in that it allows multiple variables and multiple forms (exponential, trigonometric, logarithmic, etc.) to be present in a single regression equation. The least-squares regression performed determines the constants for each of the regression equation terms to provide a best-fit curve. Other programs within the algorithm set allow for data entry, editing and printout, and plotting of the raw data and their best-fit regression curve.

SR 84-01

INTEGRATION OF LANDSAT LAND COVER DATA INTO THE SAGINAW RIVER BASIN GEOGRAPHIC INFORMATION SYSTEM FOR HYDROLOGIC MODELING.

McKim, H.L., et al, Feb. 1984, 19p., ADA-140 185, 16 refs.

Ungar, S.G., Merry, C.J., Gauthier, J.F.

38-4044

HYDROLOGY, REMOTE SENSING, TERRAIN IDENTIFICATION, LANDSAT, MODELS, RIVER BASINS, ENVIRONMENTAL IMPACT, FLOOD FORECASTING, UNITED STATES—MICHIGAN—SAGINAW RIVER.

A May 1977 Landsat-2 scene that covered approximately 85% of the Saginaw River Basin was classified into five land cover categories (urban, agriculture, forest, freshwater wetlands and open water) using a closest centroid classifier. The Landsat digital data were geometrically corrected to conform to a UTM (Universal Transverse Mercator) grid before classification. The 1.1-acre Landsat land cover classification data base was converted to 40-acre grid cells (six-by-six blocks of Landsat pixels) using an aggregation scheme and was integrated into the Detroit District's existing grid cell data base. A regression relationship between unit hydrograph parameters and the Landsat land cover classification was developed. The results indicated that the Landsat-2 land cover data were suitable for the Corps of Engineers hydrologic model.

SR 84-02

ICE OBSERVATION PROGRAM ON THE SEMISUBMERSIBLE DRILLING VESSEL SEDCO 708.

Minsk, L.D., Feb. 1984, 14p., ADA-139 992, 5 refs.

38-4045

SHIP ICING, ICE CONDITIONS, ICE FORMATION, ICE PREVENTION, PROTECTIVE COATINGS, OFFSHORE DRILLING, SHIPS, SEA SPRAY.

A semisubmersible drilling vessel (SEDCO 708) was equipped with ice detectors and ice accretion measurement devices, and observations were conducted while it drilled an exploratory well on the North Aleutian Shelf. One significant storm occurred 3-8 January 1983, which resulted in light spray ice accretion, estimated at 30 tons and a maximum thickness of 5 in. on understructure diagonal trusses. Only minor icing (less than 1 in.) occurred on the windward main columns (30 ft diameter). Comparison with the 1979 Ocean Bounty icing event suggests that wind speed is the significant parameter influencing icing severity, and that light icing will occur at average speeds around 30 knots and heavy icing around 88 knots, with undefined severity within the range. Four icephobic coatings were exposed on test panels; one was effective.

SR 84-03

U.S. AIR FORCE ROOF CONDITION INDEX SURVEY: FT. GREELY, ALASKA.

Coutermarsh, B.A., Mar. 1984, 67p., ADA-142 023, 6 refs.

38-4046

ROOFS, MOISTURE DETECTION, TESTS, DEFECTS, CRACKING (FRACTURING).

The United States Air Force Roof Condition Index Survey (RCI) procedure was studied and used on the roofs of Fort Greely, Alaska. Approximately 93 roof sections were inspected using this procedure. The results will be used in a comparison study between this method and the Army's method of infrared roof surveys and core samples. This report details the RCI method, discusses various aspects of the procedure and presents the results of the Fort Greely survey.

SR 84-04

ASSESSMENT OF ICE ACCRETION ON OFFSHORE STRUCTURES.

Minsk, L.D., Apr. 1984, 12p., ADA-141 996, 19 refs.

38-4047

ICE ACCRETION, OFFSHORE STRUCTURES, SEA SPRAY, SHIP ICING, OFFSHORE DRILLING.

The literature on sea spray (superstructure) icing is almost entirely based on observations on moving ships. However, icing on stationary offshore platforms with their fixed vertical columns will differ significantly from ship icing, which is influenced by ship movement and wind and wave directions. An observation program on offshore drilling vessels is proposed, using 1-in.-diam x 8-in.-long cylinders in arrays as a standard measuring technique for spray icing. Atmospheric icing may be a source of ice accretion on derricks in some locations, and the best commercial device currently available for measuring it is the Rosemount detector. Improved devices for both spray and atmospheric ice accretion measurements should be developed. Icephobic coatings have the potential for reducing ice accretion, and testing of candidate materials should be undertaken. Well-documented icing reports by all types of ships or platforms should be made and collected at a central clearinghouse.

SR 84-05

OPERATION OF THE U.S. COMBAT SUPPORT BOAT (USCSBMK 1) ON AN ICE-COVERED WATERWAY.

Stubstad, J., et al, Apr. 1984, 28p., ADA-142 535, 8 refs.

Rand, J.H., Jackson, L.

38-4048

MILITARY OPERATION, ICE BREAKING, RIVER CROSSINGS, CHANNELS (WATERWAYS), ICE COVER EFFECT, FAST ICE, ICE COVER THICKNESS, PONTOON BRIDGES.

From 15 January through 15 April 1982, the U.S. Combat Support Boat (USCSBMK I) was tested on the Connecticut River, in and around Hanover, New Hampshire, to examine its operation on an ice-covered waterway. The objectives were to determine to what extent shoreline ice would affect launch and recovery and if the boat could create an ice-free channel across a river so that a ribbon bridge could be floated. Shoreline ice can inhibit launch and recovery, but several solutions were developed to reduce or eliminate these problems. The boat can, to a limited extent, be used as an expedient icebreaker. It can break competent ice sheets 3.5-4 in. thick as well as significantly thicker thaw-weakened ice sheets. Sheets of well degraded "end of season" ice up to 13 in. thick were broken.

SR 84-06

MODEL TESTS IN ICE OF A CANADIAN COAST GUARD R-CLASS ICEBREAKER.

Tatinclaux, J.C., Apr. 1984, 24p., ADA-141 995, 13 refs.

38-4049

ICEBREAKERS, ICE COVER STRENGTH, ICE NAVIGATION, ICE FRICTION, STRENGTH, MODELS, TESTS, ICE SOLID INTERFACE, PROPELLERS, FORECASTING, VELOCITY.

This report presents the results of resistance and propulsion tests in level ice of a 1:20-scale model of the R-class icebreaker of the Canadian Coast Guard. On the basis of the model test results, full-scale performance is predicted and compared with available full-scale trials data. Predicted ice resistance and required propeller rpm, thrust and delivered power are lower than full-scale measurements. This disagreement was attributed to the fact that the ship model had a much lower ice friction coefficient than the prototype. On the other hand, predictions of thrust and power for a given ship speed and propeller rpm are in good agreement with corresponding full-scale measurements.

SR 84-07

MIZEX—A PROGRAM FOR MESOSCALE AIR-ICE-OCEAN INTERACTION EXPERIMENTS IN ARCTIC MARGINAL ICE ZONES. 3. MODELING THE MARGINAL ICE ZONE.

Hibler, W.D., III, ed, Apr. 1984, 99p., ADA-145 351, Discussions, p.95-98. Refs. passim. For individual papers see 39-361 through 39-374.

39-360

ICE MODELS, ICE MECHANICS, ICE EDGE, SEA ICE DISTRIBUTION, ICE WATER INTERFACE, ICE AIR INTERFACE, WIND FACTORS, ICE CONDITIONS, OCEAN CURRENTS, RHEOLOGY.

SR 84-08

ACCUMULATION, CHARACTERIZATION, AND STABILIZATION OF SLUDGES FOR COLD REGIONS LAGOONS.

Schneiter, R.W., et al, Apr. 1984, 40p., ADA-141 948, Refs. p.37-40.

Middlebrooks, E.J., Sletten, R.S., Reed, S.C.

38-4050

SEWAGE TREATMENT, SANITARY ENGINEERING, SLUDGES, FREEZE THAW CYCLES, MODELS, POLAR REGIONS.

Accumulated solids associated with the operation of aerated and facultative lagoons in cold climates were investigated to determine 1) the rate and extent of solids accumulation, 2) the characteristics of the accumulated solids, 3) the potential for in situ stabilization of the accumulated solids, and 4) the effect of lime treatment upon the pathogenic population and subsequent solids drying on sand and soil beds. Accumulated sludges from the Logan and Corinne, Utah, facultative lagoons and the Palmer and Galena, Alaska, partial mix aerated lagoons were studied. The rates of accumulation, determined by in situ measurement of the sludge layer in each lagoon, were found to vary with lagoon type and specific operational and environmental conditions.

SR 84-09

PROCEDURE FOR CALCULATING GROUNDWATER FLOW LINES.

Daly, C.J., Apr. 1984, 42p., ADA-141 947, 4 refs.

38-4051

GROUND WATER, WATER FLOW, FLUID FLOW, COMPUTER PROGRAMS, MATHEMATICAL MODELS, WATER TABLE, VELOCITY.

A methodology for the calculation of flow lines in steady or unsteady two-dimensional velocity fields is described. Although the principal application is intended to be determining fluid particle trajectories in groundwater flow, components of the methodology are relevant to more general problems of fluid flow. Two alternative numerical procedures form the core of the methodology. Each employs the method of characteristics to solve for the advection of fluid particles. The first uses an efficient, fourth-order Runge-Kutta, predictor-corrector algorithm based upon a constant time step. The second uses a fifth-order Runge-Kutta algorithm incorporating an embedded fourth-order result. This latter alternative includes automatic time-step modification and guarantees a prescribed level of accuracy. Several utility routines are provided in support of the method of characteristics.

SR 84-10

OBSERVATIONS DURING BRIMFROST '83.

Bouzoun, J.R., et al, May 1984, 36p., ADA-142 559, 2 refs.

Haynes, F.D., Perham, R.E., Walker, K.E., Craig, J.L., Collins, C.M.

38-4052

MILITARY OPERATION, COLD WEATHER OPERATION, ELECTRICAL GROUNDING, SHELTERS, WASTE DISPOSAL, SANITARY ENGINEERING, WATER SUPPLY, MILITARY EQUIPMENT, ICE CROSSINGS, TRAFFICABILITY.

During BRIMFROST '83, a biennial joint training exercise conducted in Alaska by the U.S. Readiness Command, a team from the U.S. Army Cold Regions Research and Engineering Laboratory made several trips into the exercise area to observe and document Army operations in the Arctic. This report presents an overview of the team's observations in the following areas: electrical grounding, camouflage, field fortifications, living shelters, water supply point operations, ice bridges, vehicular mobility and human and solid waste disposal.

SR 84-11

ANALYSIS OF INFILTRATION RESULTS AT A PROPOSED NORTH CAROLINA WASTEWATER TREATMENT SITE.

Abele, G., et al, May 1984, 24p., ADA-142 598, 6 refs.

Bouzoun, J.R.

38-4053

WASTE TREATMENT, WATER TREATMENT, SEEPAGE, FLOW RATE, SOILS, LAND RECLAMATION, SITE SURVEYS, TESTS.

A 6-ft-diam flooding infiltration test was conducted at a proposed wastewater land treatment site near Chapel Hill, North Carolina. The saturated infiltration rate of the soil was 0.13 in./hr, and the reaeration rate of the saturated soil was equivalent to 1.35 in. of water after six days. A conservative wastewater application rate at this site would be between 1 and 2 in./wk.

SR 84-12

DETERIORATED CONCRETE PANELS ON BUILDINGS AT SONDRESTROM, GREENLAND.

Korhonen, C., May 1984, 11p., ADA-142 595, 4 refs.

38-4054

CONCRETE STRUCTURES, CONCRETE STRENGTH, BUILDINGS, REINFORCED CONCRETES, DAMAGE, MOISTURE TRANSPORT, THERMAL EFFECTS, FREEZE THAW CYCLES, GREENLAND.

On July 22 1983 a dozen reinforced concrete buildings, built in 1954 at Sondrestrom Air Base in Greenland, were examined to determine why their concrete wall panels were cracked, spalled and rust stained. The investigation determined that structural and thermal movements caused most of this deterioration. Very little freeze-thaw deterioration was evident on the outside, but the most serious problem was that of frost damage within the wall cavities fed by moisture from the inside of each building. The visible surface defects can be repaired with breathable patching materials, but to achieve long-term success and to minimize wall-cavity frost damage, vapor migration through the walls must be properly controlled.

SR 84-13

PERFORMANCE OF THE ALLEGHENY RIVER ICE CONTROL STRUCTURE, 1983.

Deck, D.S., et al, May 1984, 15p., ADA-144 094, 3 refs.

Gooch, G.

39-381

ICE CONTROL, ICE BOOMS, RIVER ICE, FRAZIL ICE, ICE BREAKUP, ICE JAMS, UNITED STATES—PENNSYLVANIA—ALLEGHENY RIVER.

Oil City, Pennsylvania, is at the confluence of the Allegheny River and Oil Creek. The business district is located in the flood plain, and ice jam flooding has been a persistent problem. A floating ice control structure was installed on the Allegheny River prior to the 1983 ice season. The structure was a steel pontoon ice boom located upstream of Oil City and was used to encourage early formation of an ice cover at this location. This would suppress prolonged frazil ice generation, which in the past led to a massive freezeup jam downstream. This accumulation would prevent the discharge of ice from Oil Creek during breakup, when ice jam flooding would occur. The performance of the structure during its first year is documented here. Oil City escaped ice jam flooding during the winter of 1983.

SR 84-14

ON-SITE UTILITY SERVICES FOR REMOTE MILITARY FACILITIES IN THE COLD REGIONS.

Reed, S.C., et al, May 1984, 66p., ADA-142 596, 20 refs.

Ryan, W.L., Cameron, J.J., Bouzoun, J.R.

38-4055

MILITARY FACILITIES, WASTE TREATMENT, WASTE DISPOSAL, WATER TREATMENT, WATER SUPPLY, UTILITIES, COLD WEATHER PERFORMANCE, THERMAL EFFECTS, DESIGN CRITERIA.

Utility services (water, sewer, solid wastes) for small, remote military facilities in cold regions require special considerations. This report presents concepts and criteria for the planning and preliminary design of internal and external utility systems. Also included are some thermal aspects for design of these water and wastewater systems.

SR 84-15

CALCULATING BOREHOLE GEOMETRY FROM STANDARD MEASUREMENTS OF BOREHOLE INCLINOMETRY.

Jezek, K.C., et al, June 1984, 18p., ADA-145 006, 9 refs.

Alley, R.B.

39-475

BOREHOLES, ICE DRILLS, DRILLING, MEASUREMENT, GREENLAND.

This report is an extension of the authors' earlier resistance-to-ground experiments. Here they supply additional information on the influence of salt-treated backfills around grounding electrodes for reducing resistance to ground. The results are based on observations made over several seasons of freezing and thawing at sites selected for their variations in grain size, ice content, and ground temperature. More than 20 test electrodes were monitored at two silt sites and one alluvial site. The diameter of the backfilled zones, the salt content, and the backfill material were varied for the electrode borehole inclinometry data collected at DYE-3, Greenland. The methods were found convenient to use and it is claimed that the results represent physically reasonable approximations to the borehole geometry.

SR 84-17

CONDUCTIVE BACKFILL FOR IMPROVING ELECTRICAL GROUNDING IN FROZEN SOILS.

Sellmann, P.V., et al, June 1984, 19p., ADA-144 861, 14 refs.

Delaney, A.J., Arcone, S.A.

39-561

FROZEN GROUND PHYSICS, ELECTRICAL GROUNDING, ELECTRICAL RESISTIVITY, FREEZE THAW CYCLES, PERMAFROST PHYSICS, SALINE SOILS, GRAIN SIZE, SOIL TEMPERATURE, GROUND ICE, TESTS.

This report describes two new methods for computing borehole geometry from discrete measurements of borehole inclination and azimuth. In the first method borehole inclination and azimuth are assumed to vary linearly with arc length. This results in an analytic model of the borehole that is continuous but not smooth. The second model, which takes borehole inclination and azimuth to vary quadratically with arc length between three measuring points, improves the smoothness of the model but the analysis must be carried out numerically. These models were applied to the installations. In all cases salt backfilling reduced the resistance to ground, with 175 ohms being the lowest obtained. Reductions varied from very small to an order of magnitude. Resistance also decreased over several seasons. Generally the greatest improvement and lowest values were obtained in the perennially frozen silt in interior Alaska. Data from colder silt suggest that salt backfilling will not be effective in arctic settings. Measurements at a partially thawed, coarse-grained site indicate that salt was moving much more rapidly (approximately five times as fast) away from the treated backfill than at the silt site in the CRREL permafrost tunnel.

SR 84-18

EFFECT OF SEASONAL SOIL CONDITIONS ON THE RELIABILITY OF THE M15 LAND MINE.

Richmond, P.W., et al, June 1984, 35p., ADB-085 452, In English and Chinese. 2 refs.

Ho, S.C., Dittemore, H.R.

39-562

FROZEN GROUND STRENGTH, SOIL STRENGTH, MILITARY ENGINEERING, EXPLOSIVES, BLASTING, METEOROLOGICAL DATA, TESTS.

Inert M15 mines with live fuzes were tested for functioning under four soil conditions (immediately after installation in July, and in November, January and April). The mines were installed using current emplacement doctrine and initiated by driving a tank over them. Results showed significant degradation in functioning rates during winter, which was attributed to frozen soil. A change in installation doctrine is recommended.

SR 84-19

SNOW-TWO/SMOKE WEEK VI FIELD EXPERIMENT PLAN.

Redfield, R.K., et al, June 1984, 85p., ADB-089 502.

Farmer, W.M., Ebersole, J.F.

39-3031

SNOWFALL, TRANSMISSIVITY, WAVE PROPAGATION, SCATTERING, SMOKE GENERATORS, FALLING BODIES, VISIBILITY, EXPLOSIVES, SNOW COVER EFFECT, BLOWING SNOW, TESTS, HELICOPTERS.

SR 84-20

SNOW-TWO DATA REPORT. VOLUME 2: SYSTEM PERFORMANCE.

Jordan, R., ed, June 1984, 417p., ADB-101 241, Refs. passim. For Vol. 1 see 39-3031. For individual papers see 40-3773 through 40-3787.

40-3772

SNOW PHYSICS, MILITARY OPERATION, WAVE PROPAGATION, TRANSMISSION, SMOKE GENERATORS, LIGHT SCATTERING, ELECTROMAGNETIC PROPERTIES, SNOWFALL, BLOWING SNOW, VISIBILITY, DETECTION, COLD WEATHER PERFORMANCE.

the SNOW-TWO/Smoke Week VI Field Experiment held at Camp Grayling, Michigan, was a cooperative effort of the U.S. Army Cold Regions Research and Engineering Laboratory and the Office of the Project Manager Smoke/Obscurants, the main objective of which was to study the effects of manmade and natural obscurants on the performance of electro-optical and millimeter wavelength devices. This report presents the results obtained by CRREL and some 20 other agencies during the SNOW-TWO phase of the experiment, covering the periods 28 November to 21 December 1983 and 4 January to 9 March 1984. It is the fourth in a series of data reports on the SNOW field experiments sponsored by the U.S. Army Corps of Engineers Winter Battlefield Obscuration Research Program. The report is in two main volumes with a supplemental classified volume. The first volume covers the general topics of meteorology and snow characterization; the second covers the topics of electromagnetic wave transmission through falling and blowing snow, target/background signatures, and system performance in snow.

SR 84-21

RELATIONSHIPS AMONG BANK RECESSION, VEGETATION, SOILS, SEDIMENTS AND PERMAFROST ON THE TANANA RIVER NEAR FAIRBANKS, ALASKA.

Gatto, L.W., July 1984, 53p., ADA-152 332, 31 refs.

39-3030

BANKS (WATERWAYS), SOIL EROSION, PERMAFROST DISTRIBUTION, VEGETATION, RIVER FLOW, SEDIMENTS, HYDRAULICS, UNITED STATES—ALASKA—TANANA RIVER.

The objective of this analysis was to determine if available data are useful in identifying the characteristics that contribute to erodibility of the banks along two reaches of the Tanana River. Existing data on bank vegetation, soils, sediments and permafrost were used. Because these data were general and not collected for the purpose of site-specific analysis, the analytical approach was simple and did not include any statistical tests. The data were visually compared to the locations and estimated amounts of historical recession to evaluate if any relationships were obvious. The results of this analysis showed no useful relationships.

SR 84-23

BUCKLING ANALYSIS OF CRACKED, FLOATING ICE SHEETS.

Adley, M.D., et al, Aug. 1984, 28p., ADA-147 330, 24 refs.

Sodhi, D.S.

39-715

ICE LOADS, FLOATING ICE, OFFSHORE STRUCTURES, ICE SHEETS, ICE PRESSURE, ICE CRACKS, ANALYSIS (MATHEMATICS), TESTS, ICE DEFORMATION.

A buckling analysis of cracked, floating ice sheets is presented; both symmetrical and unsymmetrical shapes were investigated. The finite element method was used for the in-plane analysis as well as the out-of-plane analysis. The results of the analyses of symmetrically shaped ice sheets are compared to those of previous analyses where a radial stress field was assumed for the in-plane stresses, and there is good agreement between them. The results of theoretical analyses are compared to experimental data obtained in small-scale laboratory experiments.

SR 84-24

CLIMATE AT CRREL, HANOVER, NEW HAMPSHIRE.

Bates, R.E., Aug. 1984, 78p., ADA-148 400, 6 refs.

39-647

CLIMATE, METEOROLOGICAL DATA, SNOWFALL, PRECIPITATION (METEOROLOGY), WEATHER STATIONS, FREEZING POINTS, DEGREE DAYS, UNITED STATES—NEW HAMPSHIRE—HANOVER.

A 10-year climatological record of meteorological data collected at the CRREL meteorological station is presented for the period October 1972 through December 1982. Data presented include air temperature, heating and freezing degree-days, relative humidity, dew point, precipitation, snowfall, wind speed and direction, solar radiation and evaporation. Air temperature and precipitation monthly and annually are compared statistically to the 30-year normal and the period-of-record normal for Hanover, New Hampshire. The appendix gives daily and monthly values for the entire period of record. Some comparisons are made between the 10-year averages and the long-term normals.

SR 84-25

SALT ACTION ON CONCRETE.

Sayward, J.M., Aug. 1984, 69p., ADA-147 812, Refs. p.52-57.

39-1046

CONCRETE PAVEMENTS, SALTING, CORROSION, FREEZE THAW CYCLES, DAMAGE, REINFORCED CONCRETES, WEATHERING, BRIDGES, CHEMICAL ICE PREVENTION, CRACKING (FRACTURING).

Serious deterioration of concrete bridges by deicing salts is generally ascribed to depassivation and corrosion of reinforcing steel, as growth of its corrosion products causes spalling. Here, simple evaporative tests simulated the salt weathering that slowly crumbles rocks in nature, where crystals growing from pore water fed from below stress the matrix just as do ice crystals in frost heaving soil. Like needle ice (surface frost action in soil) the salt columns exuded from concrete also lifted tiny particles, signifying crumbling. Microcracks developed in 1-3 years of after-test dry storage.

SR 84-26

SECONDARY STRESS WITHIN THE STRUCTURAL FRAME OF DYE-3: 1978-1983.

Ueda, H.T., et al, Sep. 1984, 44p., ADA-148 401, 5 refs.

Tobiasson, W., Fisk, D., Keller, D., Korhonen, C.

39-1138

SNOW LOADS, STRESSES, MILITARY FACILITIES, STRUCTURES, FOUNDATIONS, LOADS (FORCES), WIND FACTORS, COLD WEATHER CONSTRUCTION, GREENLAND.

DEW line ice cap station DYE-3 was moved sideways 210 ft and placed on a new foundation in 1977, then raised 27 ft in 1978. Secondary forces within the structural steel framework were measured in 1978, 1981, 1982 and 1983. The overall level of secondary stresses had increased but through 1983 the columns were still within their stress limitations. Some localized overstress is expected in 1984. The concept of using above-surface trusses to resist wind loads and brace the eight columns has proven to be satisfactory. It has eliminated the subsurface enclosures used in the past to protect subsurface trusses, enclosures that proved to be the structural weak link of the original facility; their elimination has resulted in a stronger facility that is easier to maintain. The measurements and findings of this program were used in the development of the design to extend the life of DYE-3 to be implemented in 1984. That work should reduce the level of secondary stresses in the frame.

SR 84-27

DEUTERIUM DIFFUSION IN A SOIL-WATER-ICE MIXTURE.

Oliphant, J.L., et al, Sep. 1984, 11p., ADA-148 457, 7 refs.

Tice, A.R.

39-1139

FROZEN GROUND PHYSICS, ISOTOPES, SOIL WATER MIGRATION, PHASE TRANSFORMATIONS, TESTS, LABORATORY TECHNIQUES.

An experiment was performed to determine the rate of equilibration of deuterium between the ice and liquid phases of water in partially frozen soil. The results of this experiment are consistent with a diffusion rate of deuterium in ice of 1 or 2 ten-billionths sq cm/s. A method for calculating the approximate equilibration time, given the size of the ice crystals in the system, is provided. This calculation compares well with the experimental results.

SR 84-28

MIZEX—A PROGRAM FOR MESOSCALE AIR-ICE-OCEAN INTERACTION EXPERIMENTS IN ARCTIC MARGINAL ICE ZONES. 4: INITIAL RESULTS AND ANALYSIS FROM MIZEX 83. Sep. 1984, 56p., ADA-148 255, Refs. passim. For individual papers see 39-1124 through 39-1130.

39-1123

ICE MECHANICS, DRIFT STATIONS, ICE EDGE, SEA ICE DISTRIBUTION, RHEOLOGY, ICE CREEP, OCEANOGRAPHY, ICE WATER INTERFACE, ICE AIR INTERFACE, ICE CONDITIONS.

SR 84-29

MIZEX: A PROGRAM FOR MESOSCALE AIR-ICE-OCEAN INTERACTION EXPERIMENTS IN ARCTIC MARGINAL ICE ZONES. 5: MIZEX 84 SUMMER EXPERIMENT PI PRELIMINARY REPORTS.

Johannessen, O.M., ed, Oct. 1984, 176p., ADA-148 986, Refs. passim. For selected papers see 40-4691 through 40-4703.

Horn, D.A., ed.

40-4690

ICE PHYSICS, DRIFT STATIONS, ICE EDGE, SEA ICE, REMOTE SENSING, OCEANOGRAPHY, ACOUSTIC MEASUREMENT, MARINE BIOLOGY, ICE FLOES.

SR 84-30

CONVENTIONAL LAND MINES IN WINTER: EMPLACEMENT IN FROZEN SOIL, USE OF TRIP WIRES AND EFFECT OF FREEZING RAIN.

Richmond, P.W., Nov. 1984, 23p., ADB-091 027, 9 refs.

40-3580

MILITARY ENGINEERING, AUGERS, FROZEN GROUND, SNOW COVER, MINES (ORDNANCE), RAIN, FREEZING, SEASONAL VARIATIONS.

This report presents information relating to land mine use in winter. Three areas are addressed: the emplacement of mines in frozen soil, the use of trip wires in snow, and the effect of freezing rain on antitank mines. Data from a minefield installation exercise provide information on the installation of a 100-m minefield under summer and winter conditions.

SR 84-31

COMPARISON OF THREE COMPACTORS USED IN POTHOLE REPAIR.

Snelling, M.A., et al, Nov. 1984, 14p., ADA-149 937, 2 refs.

Eaton, R.A.

39-2099

ROAD MAINTENANCE, BITUMINOUS CONCRETES, COMPACTION, EQUIPMENT, DENSITY (MASS/VOLUME), TEMPERATURE EFFECTS.

This report is a summary of the results of a compaction study using recycled hot mix asphalt concrete conducted during August 1983 in an indoor facility at CRREL in Hanover, New Hampshire. This study compared three kinds of compactors for optimum performance, and also considered such factors as temperature of the asphalt concrete mix, number of passes, size and depth of patches, and the number of lifts to fill the holes. Results showed that a vibratory roller and vibratory plate compactor could both compact patches to the desired 98% of laboratory density, but that a 200-lb lawn roller could not. Temperature of the hot recycled mix is critical, with 250F being the cut-off temperature. It was shown that if the mix is not compacted promptly after placement and is allowed to cool below 250F, proper compaction may not be attained.

SR 84-32
FROZEN PRECIPITATION AND CONCURRENT WEATHER: A CASE STUDY FOR MUNCHEN/RIEM, WEST GERMANY.
Bilello, M.A., Nov. 1984, 47p., ADA-149 227, 29 refs.
39-1731
WEATHER FORECASTING, SNOWFALL, METEOROLOGICAL DATA, MILITARY OPERATION, PRECIPITATION (METEOROLOGY), VISIBILITY, FREEZING, RAIN, WINTER, CLIMATE, GERMANY—MUNICH.

This study evaluates statistical data for two or more meteorological parameters, recorded concurrently, to improve prediction of atmospheric conditions that would obscure a winter battlefield. The analysis considers only freezing precipitation types that were categorized and correlated with simultaneously observed weather conditions, such as temperature, humidity and visibility, using 11 years of winter weather records for Munchen/Riem, Federal Republic of Germany. These results are an example of the unusual and essential environmental information that can be derived from available records. It is suggested that similar investigations should be conducted for other sites in central Europe.

SR 84-33
[PROCEEDINGS].
Workshop on Ice Penetration Technology, Hanover, NH, June 12-13, 1984, Dec. 1984, 345p., ADB-093 880, Refs. passim. Discussions, p.319-336. For individual papers see 40-1962 through 40-1965.
40-1961
PENETRATION TESTS, ICE COVER STRENGTH, ICE BREAKING, MILITARY OPERATION, ICE DRILLS, ICE COVER THICKNESS, MEETINGS, SEA ICE, SUBMARINES.

SR 84-34
ICE DRILLING TECHNOLOGY.
Holdsworth, G., ed, Dec. 1984, 142p., ADA-156 733, Refs. passim. For individual papers see 40-1176 through 40-1199 or F-32743 through F-32750.
Kuivinen, K.C., ed, Rand, J.H., ed, International Workshop/Symposium on Ice Drilling Technology, 2nd, Calgary, Alberta, Aug. 30-31, 1982.
40-1175
ICE CORING DRILLS, ICE CORES, BOREHOLE INSTRUMENTS, ICE DRILLS, MEETINGS, DRILLING FLUIDS, TEMPERATURE EFFECTS.

The Symposium on Ice Drilling Technology dealt with research on the operation and design of ice coring drills. Various types of drills, as well as drilling fluids, used in the Arctic and Antarctic are described. The boreholes and ice cores are used to study ice physics and climatic changes.

SR 84-35
PROCEEDINGS, VOL.1.
Snow Symposium, 4th, Hanover, NH, Aug. 14-16, 1984, Dec. 1984, 433p., ADB-090 935, Refs. passim. For individual papers see 39-2945 through 39-2981.
39-2944
SNOW PHYSICS, SNOWFALL, TRANSMISSIVITY, MILITARY OPERATION, SNOWFLAKES, SCATTERING, SMOKE GENERATORS, AEROSOLS, MEETINGS, REFLECTIVITY, REMOTE SENSING, SPECTRA.

SR 84-36
PERMAFROST, SEASONALLY FROZEN GROUND, SNOW COVER AND VEGETATION IN THE USSR.
Bigl, S.R., Dec. 1984, 128p., ADA-153 628, Refs. p.26-31.
40-1052
PERMAFROST DISTRIBUTION, ACTIVE LAYER, SNOW COVER, VEGETATION, PERMAFROST THERMAL PROPERTIES, PERMAFROST DEPTH, GROUND ICE, SEASONAL VARIATIONS, USSR.

A survey of the Cold Regions Science and Technology Bibliography and other references in the CRREL library was conducted to compile recent information about several Soviet physiogeographic features: permafrost, seasonally frozen ground, snow cover and vegetation. The products of the study are 1) a series of maps presenting the general distribution of these features over the entire Soviet Union and 2) a collection of 57 maps showing the local distribution of ground ice and permafrost.

SR 84-37
OVERVIEW OF TANANA RIVER MONITORING AND RESEARCH STUDIES NEAR FAIRBANKS, ALASKA.
Neill, C.R., et al, Jan. 1984, 98p. + 5 appends., ADA-167 790, Refs. passim. For individual articles see 38-4207 through 38-4211.
Buska, J.S., Chacho, E.F., Collins, C.M., Gatto, L.W.
38-4206
BANKS (WATERWAYS), RIVER FLOW, SOIL EROSION, SEDIMENT TRANSPORT, FLOOD CONTROL, EMBANKMENTS, ENVIRONMENTAL IMPACT, AERIAL SURVEYS, PERMAFROST, COUNTERMEASURES, UNITED STATES—ALASKA—TANANA RIVER.

The Tanana River changes character in the vicinity of Fairbanks, from the braided pattern upstream of North Pole to the anastomosing or irregular meander pattern downstream of the Chena River confluence. This transition in planform is accompanied by a marked decrease in gradient and a change in dominant bed material from gravel to sand. Within the past 50 years the river has been affected by a variety of human activities, including flood control works, access causeways and gravel extractions. The Phase III in-river levee and groin construction constituted a strong local disturbance of the river system where local river slope was steepened and large quantities of bed material were put into transport from pilot channel enlargement as the river adjusted to the new alignment. As of the end of 1982, the full and final effects of this disturbance were not clear. Recommendations are given regarding impacts from human activities, alleviation of impacts, levee protection, further interpretive analysis and future monitoring of river behavior.

SR 85-01
CATALOG OF CORPS OF ENGINEERS STRUCTURE INVENTORIES SUITABLE FOR THE ACID PRECIPITATION-STRUCTURE MATERIAL STUDY.
Merry, C.J., et al, Mar. 1985, 40p., ADA-154 364, 4 refs.
McKim, H.L., Humiston, N.H.
39-4054
PRECIPITATION (METEOROLOGY), CHEMICAL PROPERTIES, CONSTRUCTION MATERIALS, ENVIRONMENTAL PROTECTION, DAMAGE, BUILDINGS, COST ANALYSIS, COMPUTER APPLICATIONS.

This report contains a survey of Corps of Engineers floodplain *inventories.* Its purpose was to determine if enough building materials information was available in the Corps data base to be used for predicting the distribution of building materials across the country as part of the EPA acid rain assessment program. The floodplain surveys were rated using the criteria of the date of the survey, the number of buildings, the variety of building materials, the amount of dimensions data listed for the buildings, the land cover types in the data, and whether or not the data were computerized. Six structure inventories are recommended for further study.

SR 85-02
SURVEY OF ICE PROBLEM AREAS IN NAVIGABLE WATERWAYS.
Zufelt, J., et al, Apr. 1985, 32p., ADA-157 477.
Calkins, D.J.
40-3360
ICE NAVIGATION, ICING, LOCKS (WATERWAYS), DAMS, ICE CONTROL, RIVER ICE, ICE CONDITIONS, ICE JAMS, ICE BREAKUP.

This report presents the findings of a survey of ice problems encountered on the nation's major navigable waterways. A survey questionnaire was developed and, through a field review group, was distributed to lock and dam facilities on the Allegheny, Monongahela, Ohio, Kanawha, Kaskaskia, and Mississippi Rivers and the Illinois Waterway. Analysis of the completed questionnaires identified 13 ice problem categories. The report describes each category of ice problem encountered, as well as the cited methods, operational and/or structural, undertaken to reduce the impact of each ice problem.

SR 85-03
PERIGLACIAL LANDFORMS AND PROCESSES IN THE SOUTHERN KENAI MOUNTAINS, ALASKA.
Bailey, P.K., Apr. 1985, 60p., ADA-157 459, Refs. p.54-60.
40-764
PERIGLACIAL PROCESSES, LANDFORMS, PERMAFROST DISTRIBUTION, GEOMORPHOLOGY, PATTERNED GROUND, NUNATAKS, ALTIPLANATION, NIVATION, SOIL TEMPERATURE, UNITED STATES—ALASKA—KENAI MOUNTAINS.

The distribution and characteristics of periglacial landforms in the southern Kenai Mountains, Alaska, were investigated during 1979 and 1980. The principal area of study was a 1300-m-high mountain mass that stood as a nunatak during the last general glaciation. Periglacial features in the area include gelifluction lobes, nivation hollows, cryoplanation terraces, tors, a string bog, and such patterned ground as sorted circles, sorted polygons, earth hummocks, sorted steps, sorted stripes, and small ice-wedge polygons.

SR 85-04
USER'S GUIDE FOR THE BIBSORT PROGRAM FOR THE IBM-PC PERSONAL COMPUTER.
Kyriakakis, T., et al, Apr. 1985, 61p., ADA-157 936.
Iskandar, I.K.
39-4055
DATA PROCESSING, BIBLIOGRAPHIES, MANUALS, COMPUTER PROGRAMS, COMPUTER APPLICATIONS.

This report is intended to provide the reader with step-by-step instructions on how to use the BIBSORT computer program on the IBM Personal Computer. The program allows storage and retrieval of bibliographic data. The program has been tested on an IBM-XT, using DOS 1.1 or 2.1. The program requires a monitor and a printer. This user's guide discusses how to prepare diskettes to enter the data, how to name categories and files, how to open categories and files, and how to enter data. The guide also shows how to sort and store data, edit, delete, or append the data, and how to obtain a hard copy fo the sorted data. Each data diskette can take up to 500 entries, assuming 512 characters per entry. A section on how to change the program to fit specific needs is presented in Appendix A, and the program listing is in Appendix B.

SR 85-05
WORKSHOP ON PERMAFROST GEOPHYSICS, GOLDEN, COLORADO, 23-24 OCTOBER 1984.
Brown, J., ed, May 1985, 113p., ADA-157 485, Refs. passim. For individual papers see 40-1290 through 40-1308.
Metz, M.C., ed, Hoekstra, P., ed.
40-1289
PERMAFROST PHYSICS, GEOPHYSICAL SURVEYS, PERMAFROST DISTRIBUTION, SUBSEA PERMAFROST, BOREHOLES, WELL LOGGING, MEETINGS, PERMAFROST THERMAL PROPERTIES, OIL WELLS.

SR 85-06
MIZEX—A PROGRAM FOR MESOSCALE AIR-ICE-OCEAN INTERACTION EXPERIMENTS IN ARCTIC MARGINAL ICE ZONES. 6: MIZEX-WEST.
Wadhams, P., ed, May 1985, 119p., ADA-167 310, Refs. passim. For individual papers see 40-4167 *through* 40-4180.
40-4166
SEA ICE DISTRIBUTION, ICE AIR INTERFACE, ICE WATER INTERFACE, ICE MECHANICS, REMOTE SENSING, ICE CONDITIONS, ICE EDGE, ICE FLOES, WIND FACTORS, WATER TEMPERATURE.

SR 85-07
ANALYSIS OF THE REVERE, QUINCY AND STAMFORD STRUCTURE DATA BASES FOR PREDICTING BUILDING MATERIAL DISTRIBUTION.
Merry, C.J., et al, May 1985, 35p., ADA-157 458, 8 refs.
LaPotin, P.J.
40-1010
CONSTRUCTION MATERIALS, PRECIPITATION (METEOROLOGY), CHEMICAL PROPERTIES, BUILDINGS, RAIN, FORECASTING.

Data bases on buildings in Revere and Quincy, Massachusetts, and Stamford, Connecticut, were studied to determine if a measure of building material distribution could be calculated for a city using land use, census tract and the Corps' data on buildings. Statistical measures of chi-square, asymmetric lambda, uncertainty coefficient, F ordinate, as well as the correlation coefficient-squared and eta-swuared statistics were calculated for the three data bases. The Corps definition of building type was found to be the best predictor of the building surface area. However, all indicators (including building type) explained only low percentages of the variability in the dependent variable (building surface area). These results indicate that other variables are required to explain the variability of building surface area adequately.

SR 85-08
STEFAN'S PROBLEM IN A FINITE DOMAIN WITH CONSTANT BOUNDARY AND INITIAL CONDITIONS: ANALYSIS.
Takagi, S., June 1985, 28p., ADA-158 558, 13 refs.
40-435
FROST HEAVE, BOUNDARY LAYER, STEFAN PROBLEM, ANALYSIS (MATHEMATICS).

Stefan's problem in a finite domain is solved under constant boundary and initial conditions. Starting in a semi-infinite domain, the solution passes infinitely many stages of lead times in a finite domain and finally becomes stationary. The singularity at the finite terminal necessitates introduction of lead times. Including lead times, parameters defining the solution vary with time. Only the analytical result is reported in this paper.

SR 85-09

U.S. PERMAFROST DELEGATION VISIT TO THE PEOPLE'S REPUBLIC OF CHINA, 15-31 JULY 1984.

Brown, J., June 1985, 137p., ADA-158 535, 19 refs.
40-1051

PERMAFROST BENEATH STRUCTURES, PERMAFROST THERMAL PROPERTIES, PERMAFROST DISTRIBUTION, FROZEN GROUND MECHANICS, ORGANIZATIONS, ENGINEERING, FREEZE THAW CYCLES, DAMAGE, GEOCRYOLOGY, CHINA.

A U.S. delegation of 15 scientists and engineers representing federal and state agencies, industry, and universities specializing in problems of seasonally and perennially frozen ground visited China during the period 15-31 July, 1984. The trip was organized by the Ministry of Railways and was co-hosted by the Academia Sinica's Institute of Glaciology and Cryopedology in Lanzhou. The 16-day visit was in return for a U.S.-hosted visit of a Chinese delegation to Alaska and the West Coast in July 1983 as part of the Fourth International Conference on Permafrost. The U.S. Committee on Permafrost of the National Research Council organized the U.S. participation. The facilities visited are described and technical information obtained is discussed.

SR 85-11

PREVENTION OF FREEZING AND OTHER COLD WEATHER PROBLEMS AT WASTEWATER TREATMENT FACILITIES.

Reed, S.C., et al, July 1985, 49p., ADA-160 727, 23 refs.
Pottle, D.S., Moeller, W.B., Ott, R., Peirent, R., Niedringhaus, E.L.
40-1476

UNDERGROUND FACILITIES, FREEZING, COLD WEATHER PERFORMANCE, WASTE TREATMENT. WATER TREATMENT, FROST PROTECTION, COUNTERMEASURES, DESIGN.

Freezing and other cold weather problems are a major cause of poor performance at wastewater treatment plants in cold climates. This report, based on experience in Alaska, in the north central U.S. and on a survey of over 200 treatment systems in northern New England, presents procedures and criteria so that designers can avoid cold weather problems in future systems. It also contains detailed guidance for assisting operators in overcoming current problems and deficiencies. The information is organized and presented in terms of the major process units that are likely to be found in a typical wastewater treatment system. A number of detailed case studies of problems and solutions at specific systems in northern New England are also included.

SR 85-12

SUITABILITY OF POLYVINYL CHLORIDE PIPE FOR MONITORING TNT, RDX, HMX AND DNT IN GROUNDWATER.

Parker, L.V., et al, Aug. 1985, 27p., ADA-160 733, Refs. p.19-22.
Jenkins, T.F., Foley, B.T.
40-1497

PIPES (TUBES), GROUND WATER, WATER POLLUTION, WATER CHEMISTRY, MATERIALS, TESTS, SALINITY.

A number of samples of commerical PVC groundwater monitoring pipe, which varied in schedule, diameter or manufacturer, were placed in contact with low concentrations of aqueous solutions of TNT. RDX, HMX and 2,4-DNT for 80 days under nonsterile conditions. Results indicated that there was some loss of TNT and HMX in the presence of PVC pipe compared to glass controls but that for the most part concentrations of analyte were equivalent between types of pipe. A second experiment was performed to determine if the losses were due solely to sorption or if biodegradation was also a factor. This experiment was done under a variety of groundwater conditions by varying salinity, initial pH and dissolved oxygen. The only case where there was increased loss of any substance because of the presence of PVC pipe was in the TNT solution under nonsterile conditions. This increased loss was thought to be associated with increased microbial degradation rather than sorption. Therefore, given the length of time of this experiment and the small amount of loss attributable to sorption, PVC groundwater monitoring pipe is acceptable for monitoring groundwater for these munitions. Several samples of PVC pipe were also leached with groundwater for 80 days and no detectable interferences were found by reversed phase HPLC analysis.

SR 85-13

CONSTRUCTION AND CALIBRATION OF THE OTTAUQUECHEE RIVER MODEL.

Gooch, G., Aug. 1985, 10p., ADA-159 902.
40-1545

ICE JAMS, ICE BREAKUP, RIVER ICE, ICE FORMATION, MODELS, FLOODING, WATER SUPPLY, TESTS.

The Ottauquechee River is located in west-central Vermont. This river was chosen for a physical hydraulic model using real ice. The model was built at a scale of 1:50 horizontal and 1:20 vertical. After problems with modeling bed roughness and operating the pump system were overcome, the tests went smoothly.

SR 85-15

PROCEEDINGS OF THE ISTVS WORKSHOP ON MEASUREMENT AND EVALUATION OF TIRE PERFORMANCE UNDER WINTER CONDITIONS, ALTA, UTAH, 11-14, APRIL 1983.

ISTVS Workshop on Measurement and Evaluation of Tire Performance under Winter Conditions, Alta, Utah, Apr. 11-14, 1983, Sep. 1985, 177p., ADA-161 129, Refs. passim. For individual papers see 40-3321 through 40-3335.
Blaisdell, G.L., ed, Yong, R.N., ed.
40-3320

TIRES, COLD WEATHER PERFORMANCE, MOTOR VEHICLES, ROAD ICING, MILITARY EQUIPMENT, SNOW COVER EFFECT, TRACTION, MEETINGS.

SR 85-16

SAMPLE DIGESTION AND DRYING TECHNIQUES FOR OPTIMAL RECOVERY OF MERCURY FROM SOILS AND SEDIMENTS.

Cragin, J.H., et al, Sep. 1985, 16p., ADA-161 948, 9 refs.
Foley, B.T.
40-4456

SOIL CHEMISTRY, SEDIMENTS, METALS, DETECTION, CHEMICAL ANALYSIS, DRYING.

Mercury in soils and sediments can be accurately determined over the concentration range of 0.04 to 2 microgram Hg/g using amalgamation on thin gold films. Relative standard deviation of analysis is about 10%. A mild sample dissolution technique, involving HNO3 at 75C, produced quantitative Hg recoveries for certified sediment samples and recoveries equivalent to those of rigorous Parr-bomb digestions for other soil and sediment samples. Oven drying of samples at 150C resulted in significant losses of Hg from both soil and sediment samples. Air drying, oven drying at 60C or freeze drying resulted in Hg recoveries that agreed within 20% of those for undried samples. Thus, any one of these three comparable methods is recommended for Hg determinations in soils and sediments.

SR 85-18

SNOW IN THE CONSTRUCTION OF ICE BRIDGES.

Coutermarsh, B.A., et al, Oct. 1985, 12p., ADA-163 118, 6 refs.
Phetteplace, G.
40-3269

ICE CROSSINGS, MILITARY OPERATION, SNOW (CONSTRUCTION MATERIAL), SNOW COVER EFFECT, SURFACE PROPERTIES, ICE SURFACE, ICE COVER STRENGTH.

Snow's contribution as a wearing surface, leveling material or reinforcement to ice bridges is discussed. It is shown that it has limited value as a reinforcement and then only by adding water and freezing the resulting slurry. Snow can be used effectively as either a leveling or wearing surface but natural ice thickening is inhibited by the insulating property of the snow. The snow should be of uniform depth and not mounded or windrowed to avoid deflecting the ice away from the water surface. This would substantially weaken the carrying capacity of the ice bridge.

SR 85-19

DESCRIPTION OF THE BUILDING MATERIALS DATA BASE FOR NEW HAVEN, CONNECTICUT.

Merry, C.J., et al, Nov. 1985, 129p., ADA-166 457, 13 refs.
LaPotin, P.J.
40-3270

CONSTRUCTION MATERIALS, CHEMICAL PROPERTIES, SAMPLING, DAMAGE, STATISTICAL ANALYSIS, COMPUTER APPLICATIONS, PRECIPITATION (METEOROLOGY), ENVIRONMENTAL PROTECTION.

A building material sampling program for the New Haven, Connecticut, region was conducted in March and April of 1984 to examine the types and amounts of building surface materials exposed to acid deposition. A stratified, systematic, unaligned random sampling approach was used to generate sample points across the five sampling frame areas. At least 107 sample points were examined per sampling frame to yield a total sample size of 576 points. Building sizes, surface materials, roof characteristics, roof-mounted apparatus, chimneys, gutters, downspouts, fences and miscellaneous outdoor accessories were recorded. This report provides an initial summary of the data collected. Sample sizes indicate that additional sampling is required to produce the desired 70 sites (with buildings) per frame.

SR 85-20

POTENTIAL OF REMOTE SENSING IN THE CORPS OF ENGINEERS DREDGING PROGRAM.

McKim, H.L., et al, Nov. 1985, 42p., ADA-166 334, Refs. p.23-37.
Klemas, V., Gatto, L.W., Merry, C.J.
40-3271

DREDGING, REMOTE SENSING, AERIAL SURVEYS, CHANNELS (WATERWAYS), SEDIMENT TRANSPORT, SUSPENDED SEDIMENTS, ENVIRONMENTAL IMPACT.

The potential of remote sensing in the Corps of Engineers Dredging Program for providing data on channel surveys, sediment drift and dispersion during dredging, water quality and suspended sediment concentrations, and selection of disposal sites and monitoring environmental effects at disposal sites was reviewed. The recommended remote sensor combination for recording dredging and environmental changes was a small, single-engine aircraft equipped with at least two 70-mm or 35-mm cameras. The first camera should be loaded with color film and the second camera with color infrared film for vegetation or land use mapping, or panchromatic film with special filters for water studies. For bathymetric mapping, the cameras will have to be supplemented by airborne impulse radar or laser profilers, and possibly sonar depth finders. A combination of small aircraft and boats is optimum for mapping currents and observing plume dynamics.

SR 85-22

COMPARISON OF EXTRACTION TECHNIQUES AND SOLVENTS FOR EXPLOSIVE RESIDUES IN SOIL.

Jenkins, T.F., et al, Nov. 1985, 33p., ADA-166 474, 11 refs.
Leggett, D.C.
40-3272

SOIL CHEMISTRY, EXPLOSIVES, SOIL POLLUTION, ULTRASONIC TESTS, CHEMICAL ANALYSIS.

Extraction of TNT, TNB, RDX and HMX from two soils was studied in terms of process kinetics and recovery. Two solvents, acetonitrile and methanol, and four extraction techniques, Soxhlet, ultrasonic bath, mechanical shaker and homogenizer-sonicator were compared. The results were complex in that some interactions among analyte, method and solvent were found. Acetonitrile was found to be clearly superior to methanol for RDX and HMX. Soxhlet and ultrasonic bath generally recovered more than homogenizer or shaker, although a complicating factor is that all techniques were not necessarily at equilibrium. In terms of sample throughput, the ultrasonic bath and shaker are preferred over Soxhlet and homogenizer-sonicator. The ultrasonic bath generally approached equilibrium more rapidly than the shaker so it appears to be the best overall choice. Another complicating factor is that times to reach equilibrium were different for the two soils and for the different analytes. This points to the need for more kinetic studies on other soils and sediments.

SR 85-23

PRELIMINARY INVESTIGATIONS OF MINE DETECTION IN COLD REGIONS USING SHORT-PULSE RADAR.

Arcone, S.A., Nov. 1985, 16p., ADB-100 401, 10 refs.
40-3302

DETECTION, SNOW COVER EFFECT, RADAR ECHOES, MINES (ORDNANCE), DIELECTRIC PROPERTIES, FROZEN GROUND PHYSICS, POLARIZATION (WAVES), POLAR REGIONS.

Short-pulse radar is being investigated as a tool for detecting mines in cold regions. The specific problem is the detection of mines buried in a snowpack characterized by a dielectric constant. In this preliminary investigation air and frozen sand are used to roughly approximate the dielectric extremes of a dry snowpack. The radar signal used had a duration of 3-4 ns and a broad frequency spectrum centered near 800 MHz. The responses of mines suspended in air were first recorded as a function of polarization and orientation. Mine responses were then recorded for emplacement in a fairly homogeneous dielectric of frozen sand. The waveform amplitudes depended strongly on mine orientation and weakly on polarization. Resonances in air at all orientations and polarizations for a particular mine type were similar. Responses in the sand were easily recognizable for an antenna standoff of 1 m, but depended on target size. Investigations in a snowpack are now beginning.

SR 85-24

REGRESSION MODELS FOR PREDICTING BUILDING MATERIAL DISTRIBUTION IN FOUR NORTHEASTERN CITIES.

Merry, C.J., et al, Dec. 1985, 50p., ADA-166 335, 12 refs.
LaPotin, P.J.
40-3303

CONSTRUCTION MATERIALS, BUILDINGS, POLAR REGIONS, MODELS, DISTRIBUTION.

The Corps of Engineers conducted a field sampling program for inventorying building materials in the northeastern United States, and the data from the field program were compiled into a data base for statistical analysis. Correlation coefficients were derived between the independent variables and the surface area of the five building material types. The correlation coefficients were used in an optimal stepwise regression model developed for each material class for each city. A number of factors appear to be significantly associated with the distribution of building material exposure. However, the variables do not correlate at levels required for constructing adequate predictive models that would be applicable to other sampling locations.

SR 85-25

BLASTING AND BLAST EFFECTS IN COLD REGIONS. PART 1: AIR BLAST.

Mellor, M., Dec. 1985, 62p., ADA-166 315, 23 refs.

40-3304

BLASTING, EXPLOSION EFFECTS, SHOCK WAVES, ATTENUATION, ANALYSIS (MATHEMATICS), POLAR REGIONS.

Air blast phenomena are reviewed and a digest of data is given, mainly in graphical form. To the extent possible, corresponding data are given for air blast in cold regions, provided that the prevailing conditions are significantly different from those of temperate regions.

SR 85-26

USACRREL PRECISE THERMISTOR METER.

Trachier, G.M., et al, Dec. !985, 34p., ADA-166 470, 4 refs.

Morse, J.S., Daly, S.F.

40-3305

FRAZIL ICE, WATER TEMPERATURE, THERMISTORS, ICE FORMATION, MEASURING INSTRUMENTS, ACCURACY.

To facilitate the study of frazil ice in the field, a highly accurate, portable water temperature meter was required. The USACRREL Precise Thermistor Meter was designed and built to meet this need. The meter is rugged, battery-operated, waterproof, and able to operate over a wide range of ambient temperatures. A unique feature of this instrument is the use of software to compensate for temperature-dependent variation in the analog electronics. The circuitry consists of an analog printed circuit board and a low power microcomputer. The resistance of a calibrated thermistor is determined and its temperature calculated using the Steinhart-Hart equation. The accuracy of the meter was determined both theoretically and in cold room tests. The hardware and software used in the meter are described.

SR 86-01

TECHNOLOGY TRANSFER OPPORTUNITIES FOR THE CONSTRUCTION ENGINEERING COMMUNITY: MATERIALS AND DIAGNOSTICS. 1986, 54p., ADA-166 360, Refs. passim. For selected papers see 40-4705 through 40-4708.

40-4704

DETECTION, CONSTRUCTION MATERIALS, ROOFS, PAVEMENTS, MAINTENANCE, PROTECTIVE COATINGS, THERMAL CONDUCTIVITY, CONCRETE AGGREGATES.

SR 86-02

NITROGEN REMOVAL IN COLD REGIONS TRICKLING FILTER SYSTEMS.

Reed, S.C., et al, Feb. 1986, 39p., ADA-167 118, 19 refs.

Diener, C.J., Weyrick, P.B.

40-3581

WASTE TREATMENT, WATER TREATMENT, SEEPAGE, CHEMICAL ANALYSIS, TEMPERATURE EFFECTS, DESIGN, HEAT LOSS, POLAR REGIONS.

Trickling filters are found in about 50% of the operating wastewater treatment systems owned by the U.S. Army, and more are likely for any new construction. Control of nitrogen, particularly ammonia in wastewater effluents, is a growing necessity. Ammonia can be removed in trickling filters but the process is temperature-dependent. This study combined an intensive literature review with data collection at full-scale and pilot-scale systems. These results are presented and evaluated. A liquid temperature of at least 7 C is necessary in the filter bed for effective ammonia removal, and a separate single-purpose filter bed dedicated for nitrification is recommended when significant ammonia removal is required at cold regions locations. Criteria and equations are derived for future cold region system designs.

SR 86-05

COMPARISON OF WINTER CLIMATIC DATA FOR THREE NEW HAMPSHIRE SITES.

Govoni, J.W., et al, Mar. 1986, 78p., ADA-167 427, 5 refs.

Smith, S.J.

40-3582

ICE DETECTION, ICING, METEOROLOGICAL DATA, CLIMATE, DEW POINT, WIND VELOCITY, WIND DIRECTION, PRECIPITATION (METEOROLOGY), ALTITUDE, HUMIDITY, UNITED STATES—NEW HAMPSHIRE.

This data report contains climatological measurements for the winters of 1980-81 and 1981-82 made at three sites in New Hampshire situated at elevations of 155 m, 870 m and 1910 m above sea level. Parameters measured included wind speed and direction, precipitation, temperature, humidity, and duration of icing events. Comparison of the data provides the opportunity to examine the influence of elevation on atmospheric icing occurrence and intensity. In New Hampshire, icing appears to occur only at elevations above about 900 m.

SR 86-08

DESCRIPTION OF THE BUILDING MATERIALS DATA BASE FOR PITTSBURGH, PENNSYLVANIA.

Merry, C.J., et al, Apr. 1986, 87p., ADA-167 285, 15 refs.

LaPotin, P.J.

40-3583

CONSTRUCTION MATERIALS, PRECIPITATION (METEOROLOGY), BUILDINGS, ENVIRONMENTAL PROTECTION, ROOFS, CHEMICAL ANALYSIS, STATISTICAL ANALYSIS, COST ANALYSIS, *UNITED STATES—PENNSYLVANIA*—PITTSBURGH.

A building materials sampling program for the Pittsburgh, Pennsylvania, region was conducted in December 1984 through February 1985 to examine the types and amounts of building surface materials exposed to acid deposition. A stratified, systematic, unaligned random sampling approach was used to generate sample points across six sampling frame areas. A minimum of 70 sample points was examined per sampling frame to yield a total sample size of 541 points. Building sizes, surface materials, roof characteristics, roof-mounted apparatus, chimneys, gutters, downspouts and fences were recorded. This report provides an initial summary of the data collected.

MONOGRAPHS

M 81-01

THERMAL PROPERTIES OF SOILS.

Farouki, O.T., Dec. 1981, 136p., ADA-111 734, Refs. p.125-132.

39-1258

FROZEN GROUND THERMODYNAMICS, PERMAFROST HEAT TRANSFER, FROZEN GROUND MECHANICS, SOIL PHYSICS, SOIL MECHANICS, THERMAL CONDUCTIVITY, SOIL WATER, SOIL FREEZING.

This monograph describes the thermal properties of soils, unfrozen or frozen. The effects on these properties of water and its phase changes are detailed. An explanation is given of the interaction between moisture and heat transfer. Other influences on soil thermal properties are described, including such factors as soil composition, structure, additives, salts, organics, hysteresis and temperature. Techniques for testing soil thermal conductivity are outlined and the methods for calculating this property are described. The monograph gives the results of an evaluation of these methods whereby their predictions were compared with measured values, thus showing their applicability to various soil types and conditions.

M 81-02

FROST SUSCEPTIBILITY OF SOIL; REVIEW OF INDEX TESTS.

Chamberlain, E.J., Dec. 1981, 110p., ADA-111 752, For another source see 37-973 (MP 1557). Refs. p.83-88.

39-2034

FROST HEAVE, SOIL FREEZING, SOIL MECHANICS, ICE WATER INTERFACE, ICE SOLID INTERFACE, SOIL CLASSIFICATION, TEMPERATURE GRADIENTS, SOIL WATER, PARTICLE SIZE DISTRIBUTION, GRAIN SIZE.

Methods of determining the frost susceptibility of soils are identified and presented in this report. More than one hundred criteria were found, the most common based on particle size characteristics. These particle size criteria are frequently augmented by information such as grain size distribution, uniformity coefficients and Atterberg limits. Information on permeability, mineralogy and soil classification has also been used. More complex methods requiring pore size distribuion, moisture-tension, hydraulic-conductivity, heave-stress, and frost-heave tests have also been proposed. However, none has proven to be the universal test for determining the frost susceptibility of soils. Based on this survey, four methods are proposed for further study. They are the U.S. Army Corps of Engineers Frost Susceptibility Classification System, the moisture-tension hydraulic-conductivity test, a new frost-heave test, and the CBR-after-thaw test.

M 82-01

GROWTH, STRUCTURE, AND PROPERTIES OF SEA ICE.

Weeks, W.F., et al, Nov. 1982, 130p., ADA-123 762, Refs. p.117-130.

Ackley, S.F.

37-2407

SEA ICE, ICE ELECTRICAL PROPERTIES, ICE MECHANICS, ICE SALINITY, ICE THERMAL PROPERTIES, ICE CRYSTAL STRUCTURE, ICE PHYSICS, GRAIN SIZE, ICE CRYSTAL GROWTH, GAS INCLUSIONS, TEMPERATURE EFFECTS.

This monograph describes in some detail the current state of knowledge of the observed variations in the structural characteristics (grain size, crystal orientation, brine layer spacing) and composition (brine, gas and solid salts) of sea ice as well as the presumed causes of these variations. The importance of these variations in controlling the large observed changes in the mechanical, thermal and electrical properties of the sea ice is also discussed.

M 83-1

MECHANICAL BEHAVIOR OF SEA ICE.

Mellor, M., June 1983, 105p., ADA-131 852, Refs. p.99-105.

38-469

SEA ICE, ICE MECHANICS, ICE ELASTICITY, ICE STRENGTH, FRACTURING, FLEXURAL STRENGTH, STRESSES, STRAINS, RHEOLOGY, MECHANICAL PROPERTIES, PRESSURE RIDGES, ANALYSIS (MATHEMATICS).

The first part of the report provides an introduction to the mechanics of deformable solids, covering the basic ideas of stress and strain, rheology, equilibrium equations, strain/displacement relations, constitutive equations, and failure criteria. Fracture mechanics and fracture toughness are also reviewed briefly. The second part of the report summarizes available data on the mechanical properties of freshwater ice and saline ice, accounting for the influences of strain rate and loading rate, temperature, porosity, salinity, and grain size. Boundary value problems are not dealt with, but there is discussion of some miscellaneous topics, including thermal strains, behavior of brash ice, and pressure ridges. The report was written as a study text for a NATO Advanced Study Institute on Sea/Ice/Air Interactions, and was intended to be used in conjunction with companion texts on related topics.

M 84-01

FRAZIL ICE DYNAMICS.

Daly, S.F., Apr. 1984, 46p., ADA-142 037, Refs. p.44-46.

38-4420

FRAZIL ICE, ICE MECHANICS, ICE CRYSTAL GROWTH, ICE CRYSTAL NUCLEI, HEAT TRANSFER, ICE FORMATION, ICE PREVENTION, SUPERCOOLING, TURBULENT FLOW, ANALYSIS (MATHEMATICS).

To describe the dynamic evolution of frazil ice in turbulent natural water bodies, the basic equation for dynamic frazil crystal number continuity and the basic equation of heat balance for a differential volume are developed. Crystal growth and nucleation of new crystals are the major parameters in these equations. Expressions for the growth rate of frazil ice crystals are described. The growth rate along the major axis is controlled by heat transfer. The heat transfer coefficient is a function of crystal size, the fluid turbulence, and the fluid properties. The magnitude of inertial and buoyancy forces on the ice crystals are determined as is their influence on the heat transfer. Spontaneous nucleation of ice can be discounted; secondary nucleation is responsible for the vast majority of frazil ice crystals. The theoretical rate of secondary nucleation is partially modeled as a function of the supercooling, fluid turbulence and crystal size distribution. A simple analytical solution of the basic equations is developed for the growth of frazil ice in a well-mixed, steady-state crystallizer.

M 84-02

ATMOSPHERIC ICING ON SEA STRUCTURES.

Makkonen, L., Apr. 1984, 92p., ADA-144 448, Refs. p.77-92.

39-97

ICING, OFFSHORE STRUCTURES, ICE ACCRETION, ICE PREVENTION, ICE ADHESION, ICE SOILD INTERFACE, ICE PHYSICS, CLIMATIC FACTORS, ICE LOADS, SUPERCOOLING, ANALYSIS (MATHEMATICS), DESIGN.

Atmospheric icing (icing due to fog, precipitation and water vapor in air) as a physical process and the problems it causes for ships and stationary offshore structures are reviewed. Estimation of the probability and severity of atmospheric icing based on climatological and geographical factors is discussed, and theoretical methods for calculating the intensity of atmospheric icing at sea are suggested. Existing data on the dependence of the atmospheric icing rate and the properties of the accreted ice on the meteorological conditions are analyzed. The methods of measuring the icing rate and ice prevention methods are discussed.

M 84-03

ICE DYNAMICS.

Hibler, W.D., III, July 1984, 52p., ADA-147 376, Refs. p.48-52.

39-896

ICE MECHANICS, RHEOLOGY, DRIFT, THERMODYNAMICS, ICE PLASTICITY, OCEANOGRAPHY, SEA ICE, ICE FORMATION, ICE AIR INTERFACE, ICE WATER INTERFACE, ICE STRENGTH, ICE COVER THICKNESS, ICE MODELS, SEA WATER, ANTARCTICA—WEDDELL SEA.

This monograph reviews essential aspects of sea ice dynamics of the Arctic and Antarctic on the geophysical scale and discusses the role of ice dynamics in air-sea-ice interaction. The review is divided into the following components: a) a discussion of the momentum balance describing ice drift, b) an examination of the nature of sea ice rheology on the geophysical scale, c) an analysis of the relationship between ice strength and ice thickness characteristics, and d) a discussion of the role of ice dynamics in the atmosphere-ice-ocean system. Because of the unique, highly nonlinear nature of sea-ice interaction, special attention is given to the ramifications of ice interaction on sea ice motion and deformation. These ramifications are illustrated both by analytic solution and by numerical model results. In addition, the role of ice dynamics in the atmosphere-ice-ocean system is discussed in light of numerical modeling experiments, including a fully coupled ice-ocean model of the Arctic-Greenland-Norwegian seas.

M 85-01

EROSION OF NORTHERN RESERVOIR SHORES. AN ANALYSIS AND APPLICATION OF PERTINENT LITERATURE.

Lawson, D.E., May 1985, 198p., ADA-157 811, Refs. p.137-191.

40-4448

SHORE EROSION, ICE COVER EFFECT, RESERVOIRS, SLOPE PROCESSES, PERMAFROST, SHORELINE MODIFICATION, GROUND WATER, WATER LEVEL, MODELS, WATER WAVES, FORECASTING, TEMPERATURE EFFECTS.

This monograph describes the current state of knowledge of northern reservoir shore erosion, primarily by examining the results of erosional studies on lakes, coasts and rivers. The major erosional processes of reservoir beaches and bluffs and their mechanics are discussed in detail. Thermal and physical parameters affecting the erodibility of shores, the environmental impacts of erosion, and the basic characteristics of the unique reservoir environment are reviewed. Current models of shore zone development are also presented. This literature analysis revealed that knowledge of erosion and recession in northern impoundments is severely limited. Quantitative analyses of the processes of erosion and their relative importance, parameters determining the nature, rate and timing of erosion, and models to predict the erodibility of a shore for use in minimizing shoreline recession remain in need of basic field research.

TECHNICAL DIGESTS

TD 81-01

USING ELECTRONIC MEASUREMENT EQUIPMENT IN WINTER.

Atkins, R.T., July 1981, 7p., ADA-148 795, 5 refs.

39-2092

ELECTRONIC EQUIPMENT, COLD WEATHER PERFORMANCE, MEASURING INSTRUMENTS, SEMICONDUCTORS (MATERIALS), THERMAL INSULATION, CABLES (ROPES), WINTER, TEMPERATURE EFFECTS.

TD 82-01

FREEZING AND BLOCKING OF WATER PIPES.

Carey, K.L., May 1982, 11p., ADA-148 943, 10 refs.

39-2093

PIPELINE FREEZING, WATER FLOW, ICE FORMATION, WATER PIPES, TEMPERATURE EFFECTS, COUNTERMEASURES, DESIGN, ICE CONTROL, WATER PRESSURE, FREEZEUP.

TD 83-01

MELTING ICE WITH AIR BUBBLERS.

Carey, K.L., Mar. 1983, 11p., ADA-148 739, 7 refs.

39-2094

ICE MELTING, BUBBLING, FLOATING ICE, ICE BREAKING, ICE CONTROL, PORTS, PIERS, DOCKS, ANALYSIS (MATHEMATICS).

TD 83-02

ICE-BLOCKED DRAINAGE: PROBLEMS AND PROCESSES.

Carey, K.L., Nov. 1983, 9p., ADA-148 738, 2 refs.

39-2095

PIPELINE FREEZING, DRAINAGE, CULVERTS, ICE FORMATION, FREEZEUP, ICE REMOVAL, DESIGN, COUNTERMEASURES, HEAT TRANSFER, WINTER MAINTENANCE.

TD 84-01

ENGINEER'S POTHOLE REPAIR GUIDE.

Eaton, R.A., et al, Mar. 1984, 12p., ADA-148 736, 3 refs.

Wright, E.A., Mongeon, W.E.

39-2096

ROAD MAINTENANCE. WINTER MAINTENANCE, DAMAGE, ENGINEERING, PAVEMENTS.

TD 84-02

SOLVING PROBLEMS OF ICE-BLOCKED DRAINAGE.

Carey, K.L., Sep. 1984, 9p., ADA-148 737, 4 refs.

39-2097

DRAINAGE, ICE FORMATION, PIPELINE FREEZING, CULVERTS, ICE REMOVAL, ICE CONTROL, ENGINEERING, COUNTERMEASURES, FREEZEUP.

TD 86-01

INTRODUCTION TO HEAT TRACING.

Henry, K., June 1986, 20p., Refs. p.18-20.

40-4447

HEATING, HEAT TRANSFER, PIPELINE FREEZING, SHIP ICING, FREEZING, COUNTERMEASURES, PROTECTION.

MISCELLANEOUS PUBLICATIONS

MP 843

ON THE USE OF TENSIOMETERS IN SNOW HYDROLOGY.

Colbeck, S.C., *Journal of glaciology,* 1976, 17(75), p.135-140, 11 refs.

30-3540

SNOW HYDROLOGY, MEASURING INSTRUMENTS, WATER PRESSURE.

The construction and use of snow-water tensiometers is described. Water pressure at the base of a shallow, Arctic snow-pack was measured to illustrate the response of the basal layer to water percolation. Water tension above an ice layer and water flux through the ice layer were measured in glacial snow. The gravity flow theory is used to explain the close agreement between these parameters. This suggests that the ice layer has little effect on the flow field and that gravity (rather than tension gradients) controls the flow. Further work on water tensions is needed to identify the role of tension gradients in ripening and shallow snow covers. (Auth.)

MP 844

SNOW AND ICE.

Colbeck, S.C., et al, *Reviews of geophysics and space physics,* July 1975, 13(3), p.435-441, 475-487, Refs. p.475-487.

Thorndike, A.S., Willans, I.M., Hodge, S.M., Ackley, S.F., Ashton, G.D.

30-2083

ICE SHEETS, ICE SHELVES, SNOW SURVEYS, SEA ICE, GLACIOLOGY, ICE PHYSICS, RESEARCH PROJECTS.

MP 845

THIRD INTERNATIONAL SYMPOSIUM ON ICE PROBLEMS.

Frankenstein, G.E., ed, International Association of Hydraulic Research, 1975, 627p., For individual papers see 30-2708 through 30-2759.

30-2707

ICE NAVIGATION, RIVER ICE, ICE JAMS, SEA ICE, ICE LOADS, HYDRAULIC STRUCTURES, MEETINGS.

MP 846

RESURVEY OF THE "BYRD" STATION, ANTARCTICA, DRILL HOLE.

Garfield, D.E., et al, *Journal of glaciology,* 1976, 17(75), p.29-34, 4 refs.

Ueda, H.T.

30-3529

BOREHOLE INSTRUMENTS, ICE SHEETS, FLOW MEASUREMENT, MECHANICAL PROPERTIES, ANTARCTICA—BYRD STATION.

The drill hole at "Byrd" station, which was completed in Jan. 1968 to a vertical depth of 7063 ft (2153 m) below the top of the hole casing, was resurveyed in Jan. 1975 to a vertical depth of 4835 ft (1474 m). Inclination and azimuth measurements were made with a Parsons multiple shot inclinometer and compared with the earlier measurements made during drilling. The results indicate a progressively increasing displacement with depth to a value of 51.2 ft (15.6 m) or about 7.3 ft/year (2.23 m/year) at the 4835 ft (1474 m) level. The direction of movement relative to the surface varies from south-west at 300 ft (91.5 m) to north-east at 1100 ft (335 m) to east at 3368 ft (1027 m) to north-east at 4835 ft (1474 m), indicative of a complex twisting motion. An increase in accessible depth along the hole axis of 18 ft (5.49 m) beyond the 1969 depth was noted. No attempt was made to measure the hole diameter or vertical strain. It is recommended that the hole be resurveyed in 3-5 years if it is still logistically feasible, using a more up-dated inclinometer. (Auth.)

MP 847

GAS INCLUSIONS IN THE ANTARCTIC ICE SHEET AND THEIR GLACIOLOGICAL SIGNIFICANCE.

Gow, A.J., et al, *Journal of geophysical research,* Dec. 20, 1975, 80(36), p.5101-5108, 16 refs.

Williamson, T.

30-2295

ICE SHEETS, DRILL CORE ANALYSIS, GAS INCLUSIONS, BUBBLES, AIR ENTRAINMENT, ICE PRESSURE, ANTARCTICA—BYRD STATION.

Cores obtained to the bottom of the Antarctic Ice Sheet at Byrd Station have been used to analyze some physical properties of the air bubbles trapped in the ice. These bubbles constitute the remnant air that is retained when polar snow transforms into glacial ice. Parameters measured include size, shape, abundance, and spatial distribution of bubbles, gas volumes, and bubble pressures and their variations with depth in the ice sheet. Bubbles occur abundantly in the top 800 m of ice but then gradually disappear until they can no longer be detected optically below 1100 m. This disappearance is not accompanied by any significant loss of air from the ice, and the available evidence suggests that the air is retained in the form of a gas hydrate or clathrate. Because of the release of confining pressures following drilling, the hydrate begins to decompose soon after cores are pulled to the surface. This decomposition is accompanied by the growth of gas-filled bubblelike cavities that are easily distinguishable from original air bubbles. Bubble pressure measurements show that (1) bubbles with pressures exceeding about 16 bars begin to relax back to this value soon after in situ pressures are relieved by drilling, (2) further slow decompression will occur with time, and (3) the rate of decompression is controlled to some extent by the intrinsic structural properties of the ice and its thermal and deformational history. Only small variations were observed in the entrapped air content of the ice cores; they probably reflect variations in the temperature and/or pressure of the air at the time of its entrapment. Only in ice from the bottom 4.83 m was the air content observed to decrease to trace amounts. Since this virtual absence of air coincided precisely with the first appearance of stratified moraine in the cores, it is concluded that this ice originated from the refreezing of air-depleted water produced under pressure melting conditions at the bottom of the ice sheet.

MP 848

HEIGHT VARIATION ALONG SEA ICE PRESSURE RIDGES AND THE PROBABILITY OF FINDING "HOLES" FOR VEHICLE CROSSINGS.

Hibler, W.D., III, et al, *Journal of terramechanics,* Dec. 1975, 12(3/4), p.191-199, 5 refs. For this paper from another source see 28-3039.

Ackley, S.F.

30-3387

SEA ICE, PRESSURE RIDGES, AIR CUSHION VEHICLES, ICE CROSSINGS, HEIGHT FINDING.

Sea ice pressure ridges are major obstacles to vehicle mobility in the Arctic Basin. An estimate of the expectation of holes of various heights and widths in the ridges is desirable for optimum vehicle design. This study uses probability theory and ridge shadow measurements from aerial photographs of sea ice to determine the distribution of holes of various heights and widths in pressure ridges. General conclusions are drawn regarding trafficability of this terrain for vehicles of various sizes.

MP 849

MEASUREMENT OF SEA ICE DRIFT FAR FROM SHORE USING LANDSAT AND AERIAL PHOTOGRAPHIC IMAGERY.

Hibler, W.D., III, et al, International Symposium on Ice Problems, 3rd, Hanover, New Hampshire, 18-21 August 1975. Proceedings, International Association of Hydraulic Research, 1975, p.541-554, 6 refs.

Tucker, W.B., Weeks, W.F.

30-2755

SEA ICE, AERIAL SURVEYS, PHOTOGRAMMETRY, ICE DEFORMATION, DRIFT, LANDSAT.

This paper discusses recent work on the development of analysis procedures for obtaining drift and deformation measured from sequential visual imagery of sea ice that is located far from land. In particular for LANDSAT images far from land a semi automatic procedure for transferring the location coordinates of a common set of ice features from the Earth coordinate system of one image to another is discussed. Necessary inputs for the transfer are the location coordinates (latitude and longitude) of the center of each image and the location of two arbitrary points on a known line of longitude; all this information is available from LANDSAT, although with some error. These errors will produce spurious apparent strains if velocities are estimated by simply taking position differences. With regard to measuring strain from sea ice aerial imagery without ground control, errors in such measurements are examined using uncorrected photographs. The errors in using such uncorrected imagery and using common undeformed ice floes to establish a common scale are found to be of the order of 1% whereas typical maximum differential motions are as large as 5%.

MP 850

STATISTICAL VARIATIONS IN ARCTIC SEA ICE RIDGING AND DEFORMATION RATES.

Hibler, W.D., III, Ice Tech Symposium, Montreal, Canada, April 9-11, 1975. Proceedings, New York, *Society of Naval Architects and Marine Engineers,* 1975, p.J1-J16, 13 refs. Includes discussions.

30-1846

SEA ICE, PACK ICE, ICE DEFORMATION, ICE PRESSURE, OFFSHORE STRUCTURES, ICE CONDITIONS, STRESSES, ICE NAVIGATION, STATISTICAL DATA.

Past studies of statistics of pressure ridges have supplied useful information on the nature of pressure ridge height and spacing distributions as well as information on geographical and temporal variations in ridging. These statistics should be of some aid in the construction of Arctic offshore structures and in icebreaking and shipping operations. By coupling these height and spacing statistics with information on ridge lengths, the amount of detouring necessary to avoid ridges may be estimated. Closely associated with ridging are drift and deformation studies. Two aspects of these studies applicable to this conference are (1) the prediction of the rate of opening and closing of the pack ice, and (2) estimation of typical geophysical stresses in the ice pack. Theoretical and experimental work at CRREL indicates that certain approximate rules may be invoked to estimate the divergence rate far from coastal boundaries, namely that in winter the pack ice should diverge in reasonably well localized high pressure systems, whereas in summer the ice typically diverges in low pressure systems. As regards estimates of geophysical stresses, estimates from a variety of sources suggest that maximum stresses integrated through the pack ice thickness are of the order of 10,000 to 100,000 N/m. The upper limit is approximately equal to the force required to crush 0.25-meter-thick sea ice.

MP 851

CONTINUOUS MONITORING OF TOTAL DISSOLVED GASES, A FEASIBILITY STUDY.

Jenkins, T.F., Gas Bubble Disease Conf-741033, Battelle, Pacific Northwest Laboratories, Richland, Washington, Oct. 8-9, 1974, Proceedings, 1975, p.101-105, 7 refs.

31-1900

BUBBLES, WATER, GAS INCLUSIONS, SURVIVAL, EXPERIMENTATION, MONITORS.

A preliminary investigation was undertaken to determine if a continuous analyzer could be configured to monitor dissolved gases in natural waters. A three-component system was designed consisting of a pumping system, a continuous stripper, and a detector. Prototypes of the first two components were assembled and evaluated under field conditions. Based upon these results, it is possible to configure an unattended, near-continuous monitor to measure total dissolved gas concentration in natural waters.

MP 852

ISLANDS OF GROUNDED ICE.

Kovacs, A., et al, *Arctic,* Sep. 1975, 28(3), p.213-216, 10 refs.

McKim, H.L., Merry, C.J.

30-3067

SEA ICE, GROUNDED ICE, ERTS IMAGERY.

The report demonstrates the usefulness of ERTS-1 imagery for locating and identifying islands of grounded ice. Several examples are cited.

MP 853

IDENTIFICATION OF NUCLEI AND CONCENTRATIONS OF CHEMICAL SPECIES IN SNOW CRYSTALS SAMPLED AT THE SOUTH POLE.

Kumai, M., *Journal of the atmospheric sciences,* May 1976, 33(5), p.833-841, 16 refs.

30-3647

SNOW COMPOSITION, CLAY MINERALS, SNOW CRYSTAL NUCLEI, ANTARCTICA—SOUTH POLE.

A total of 380 electron micrographs and electron diffraction patterns of 93 snow crystal nuclei were analyzed in this observation. The nuclei were identified as mainly clay minerals and sodium chloride particles. The clay mineral nuclei were illite 20%, kaoline 8%, halloysite 4%, vermiculite 3%, and related minerals 24%. For the other nuclei, sodium chloride accounted for 20%, and unidentified nuclei accounted for 5%. Fifteen percent of the snow crystals did not appear to have nuclei. Therefore, all nuclei found in snow crystals were terrestrial substances from oceans and continents. The shapes of snow crystals were single bullets, combinations of bullets, and hexagonal hollow columns. The snow crystals formed at temperatures from -30 to -35C. The snow crystal diameters were from 0.1 to 1.0 mm. The mean mass concentration of sodium chloride in snow crystals was 40.6 ppb and that of clay minerals was 15.4 ppb. The sodium chloride nucleus concentration coincided within the experimental error with data taken from the chemical analysis of the South Pole snow cover made by several workers. It was concluded that most of the sodium chloride contained in the South Pole snow cover was due to the sodium chloride nuclei of snow crystals.

MP 854

OPTICAL PROPERTIES OF SALT ICE.

Lane, J.W., *Journal of glaciology,* 1975, 15(73), Symposium on Remote Sensing in Glaciology, Cambridge, 16-20 September, 1974, p.363-372, 12 refs., In English with French and German summaries. Includes discussion. 66 refs.

30-2349

SALT ICE, ICE OPTICS, LIGHT SCATTERING.

The dependence of the extinction coefficient on salinity was investigated for both NaCl-ice and salt-ice made from natural sea-water. Specimens were prepared under a variety of conditions and examined over the wavelength range 4,000 to 8,000 A. The effects of scattering from air bubbles trapped in the ice were examined for ice made from distilled water. It was found that the method of preparing samples markedly affected their structure, but that, when prepared in the same manner, salt-ice made from natural sea-water and NaC1-ice did not show significantly different transmission properties. It was found that, for a wavelength of 6328 A, the data could be fit to the relation ke=[1.67-0.85 exp (-0.27x)]/cm within an uncertainty of 26%, where ke is the extinction coefficient, and x is the salinity of the ice in g/kg. Within an uncertainty of 10%, there was no variation in transmission for ice at the same temperature and salinity over the wavelength range 4000 to 8000 A. All measurements were made at a temperature of -200C.

MP 855

MECHANISMS OF CRACK GROWTH IN QUARTZ.

Martin, R.J., III, et al, *Journal of geophysical research,* Dec. 10, 1975, 80(35), p.4837-4844, 21 refs.

Durham, W.B.

30-3068

ROCKS, CRACK PROPAGATION, WATER TRANSPORT, QUARTZ.

A previous study of time-dependent crack growth in single-crystal quartz has been expanded to examine the possibility of microfracturing events during stable crack growth, to look for evidence of plastic deformation associated with crack propagation, and to determine the dependence of crack growth on crystallographic orientation. No discernible effect of orientation on the temperature or change in applied stress or partial pressure of water dependencies during sequential crack growth episodes was observed, and no correlation was found between observed microfracturing events and the rate of crack propagation. However, the magnitude of the applied stress to achieve the desired rates of crack extension did vary with orientation. No evidence of plastic deformation has been found in samples of quartz undergoing time-dependent crack growth at temperatures up to 250C. Some Dauphiné twins have been observed at temperatures above 125C. The fact that the stress, temperature, and water dependencies are independent of orientation is interpreted to suggest that the observed time-dependent cracking is controlled by the transport of water to the crack tip.

MP 856

GENERAL CONSIDERATIONS FOR DRILL SYSTEM DESIGN.

Mellor, M., et al, Ice core drilling, edited by J.F. Splettstoesser, Lincoln, University of Nebraska Press, 1976, p.77-111, 58 refs.

Sellmann, P.V.

30-3483

ICE CORING DRILLS, DRILLING, ROTARY DRILLING, THERMAL DRILLS.

Drilling systems are discussed in general terms, component functions common to all systems are identified, and a simple classification is drawn up in order to outline relations between penetration, material removal, hole wall support, and ground conditions. Energy and power requirements for penetration of ice and frozen ground are analyzed for both mechanical and thermal processes. An electromechanical coring drill has been used for deep drilling in Greenland and Antarctica. Thermal drills have also been used for boring holes in ice although they are not as efficient, in energetic terms, as mechanical drills. Power requirements for removal of material and for hoisting of drill strings are considered, and total power requirements for complete systems are assessed. Performance data for drilling systems working in ice and frozen ground are reviewed, and results are analyzed to obtain specific energy values. Specific energy data are assembled for drag-bit cutting, normal impact and identation, liquid jet attack, and thermal penetration. Torque and axial for capabilities of typical rotary drilling systems are reviewed and analyzed. The overall intent is to provide data and quantitive guidance that can lead to systematic design procedures for drilling systems for cold regions. (Auth. mod.)

MP 857

COMPUTER SIMULATION OF THE SNOWMELT AND SOIL THERMAL REGIME AT BARROW, ALASKA.

Outcalt, S.I., et al, *Water resources research,* Oct. 1975, 11(5), p.709-715, 17 refs. For another version of this paper see 29-4001.

Goodwin, C., Weller, G., Brown, J.

30-2133

COMPUTERIZED SIMULATION, SNOW TEMPERATURE, SOIL TEMPERATURE, THERMAL DIFFUSION, SNOW FENCES, WATER SUPPLY.

An annual snow-soil simulator for arctic tundra was developed by using coupled models of surface equilibrium temperature and substrate thermal diffusion. Snow ripening, melt, and accumulation are modeled in the simulator which is forced with daily weather data. The simulator predicts that a snow fence array capable of producing drift deeper than 4.2 m will initiate a permanent snowfield at Barrow, Alaska. Such a man-induced snowfield could serve as a reliable source of freshwater for Barrow and similar villages in the north slope region of Alaska. Further analysis indicated that albedo reduction due to dust fall, snow removal, etc., is dominant over aerodynamic effects in producing the early spring meltout observed at Barrow Village.

MP 858

FORCES ON AN ICE BOOM IN THE BEAUHARNOIS CANAL.

Perham, R.E., et al, International Symposium on Ice Problems, 3rd, Hanover, New Hampshire, 18-21 August 1975. Proceedings, International Association of Hydraulic Research, 1975, p.397-407, 7 refs.

Racicot, L.

30-2743

ICE BOOMS, SHEAR STRESS, ICE PRESSURE, LOADS (FORCES).

Ice booms are used to hasten the formation of a stable ice cover in early winter. Their main function is to reduce the area of open water where large amounts of ice floes and frazile ice can be generated. This ice, if uncontrolled, can cause an ice jam or blockage at power house intakes and restrict its generating capacity. A particular function of the forebay ice boom of the Beauharnois Power House is to prevent any ice upstream from moving down into the forebay. In the winter of 1974-75 CRREL obtained force measurements of both cross stream and downstream components in the forebay ice boom. The purpose of this paper is to report these forces and their variations. A limited amount of supplemental data such as water flow, ice thickness, and canal dimensions is provided. All of the information should help in the understanding of interaction between an ice boom and its ice cover.

MP 859

CONSTRUCTION AND PERFORMANCE OF THE HESS CREEK EARTH FILL DAM, LIVENGOOD, ALASKA.

Simoni, O.W., *Northern engineer,* Fall 1975, 7(3), p.23-34, Also presented at the American Society of Civil Engineers, Alaska Section, Annual Meeting, Fairbanks, September 18-29, 1973. See also 27-177, TR 196.

31-1291

EARTH DAMS, PERMAFROST BENEATH STRUCTURES, PERMAFROST PRESERVATION, HYDRAULIC FILL, EARTH FILLS, UNITED STATES—ALASKA—LIVENGOOD.

MP 860

SNOW ACCUMULATION FOR ARCTIC FRESH-WATER SUPPLIES.

Slaughter, C.W., et al, *Arctic bulletin,* 1975, 1(5), p.218-224, 15 refs. For another version see 29-3345.

Mellor, M., Sellmann, P.V., Brown, J., Brown, L.

31-3104

WATER SUPPLY, SNOW ACCUMULATION, RUNOFF, MELTWATER, SNOW FENCES.

MP 861

APPROXIMATE ANALYSIS OF MELTING AND FREEZING OF A DRILL HOLE THROUGH AN ICE SHELF IN ANTARCTICA.

Tien, C., et al, *Journal of glaciology,* 1975, 14(72), p.421-432, 3 refs.

Yen, Y.-C.

30-3106

ICE DRILLS, BOREHOLES, FREEZE THAW TESTS, ICE SHELVES, ANALYSIS (MATHEMATICS).

An approximate analysis is made, of the processes of melting and freezing of a drill hole, 500 m in depth and 0.15 m in initial radius, through an ice shelf in Antarctica. Results are expressed in graphical form showing the time available for experimentation under the hole as a function of heating duration. It is also found that refreezing has a much slower rate than melting. (Auth.)

MP 862

REMOTE SENSING PLAN FOR THE AIDJEX MAIN EXPERIMENT.

Weeks, W.F., et al, *Arctic Ice Dynamics Joint Experiment. AIDJEX bulletin,* July 1975, No.29, p.21-48, 14 refs.

Campbell, W.J.

30-2440

REMOTE SENSING, SPACECRAFT, AIRBORNE EQUIPMENT, SEA ICE, ICE COVER THICKNESS, DATA PROCESSING.

This operational plan describes the platforms and sensors that are expected to participate in AIDJEX, explains how they will be used to obtain the required data, discusses the analysis of those data, and points out weaknesses in the remote sensing plan as now formulated. The details of the plan have changed constantly as an overall remote sensing strategy was being developed. This document presents the state of the plan as of the start of the field program, in March 1975.

MP 863

ICE FORCES ON MODEL STRUCTURES.

Zabilansky, L.J., et al, *Canadian journal of civil engineering,* 1975, 2(4), p.400-407, In English with French summary. 11 refs.

Nevel, D.E., Haynes, F.D.

30-3095

ICE PRESSURE, HYDRAULIC STRUCTURES, PILE STRUCTURES, MODELS, LABORATORY TECHNIQUES.

Laboratory tests on freshwater ice were conducted by using model structures of various geometries. Vertical and sloping pile sections with diameters up to 36 in. (91.4 cm) were pushed through the ice with an active testing system. The test variables investigated were size, shape, velocity, and slope or angle from the vertical. The data gathered in this study indicates that nominal ice pressure varies indirectly with pile width/ice thickness (D/T) ratio in the range of 1:10. There was no apparent change in nominal ice pressure due to the change of the pile shape. Data gathered in the velocity tests suggests an inverse effect upon the ice pressure, especially at speeds greater than 3 in./s (7.6 cm/s). In the sloping pile tests it was found that the ice pressure decreased with an increase in the slope angle from the vertical position. An expression correlating the vertical and horizontal forces in the sloping pile tests that failed in bending was developed. Values for this linear correlation were found graphically. A comparison of the test results with other investigations is also presented.

MP 864

ICE FORCES ON SIMULATED STRUCTURES.

Zabilansky, L.J., et al, International Symposium on Ice Problems, 3rd, Hanover, New Hampshire, 18-21 August 1975. Proceedings, International Association of Hydraulic Research, 1975, p.387-396, 1 ref.

Nevel, D.E., Haynes, F.D.

30-2742

ICE PRESSURE, LOADS (FORCES), OFFSHORE STRUCTURES, PILE STRUCTURES, MODELS.

Simulated structures mounted on a portable apparatus were used to investigate ice forces on marine structures. Various geometric shapes of simulated structures or piles were pushed against natural lake ice. Parameters varied were size, shape, pile velocity, friction, initial pile-ice contact and slope of the pile.

MP 865

INVESTIGATION OF WATER JETS FOR LOCK WALL DEICING.

Calkins, D.J., et al, International Symposium on Jet Cutting Technology, 3rd, Chicago, May 11-13, 1976, Proceedings, 1976, p.G2/13-22, 17 refs.

Mellor, M.

31-1898

ICE REMOVAL, WALLS, CHANNELS (WATERWAYS).

MP 866

TECHNIQUES FOR STUDYING SEA ICE DRIFT AND DEFORMATION AT SITES FAR FROM LAND USING LANDSAT IMAGERY.

Hibler, W.D., III, et al, International Symposium on Remote Sensing of Environment, 10th, Oct.6-10, 1975, 1976, p.595-609, ADA-041 579, 12 refs.

Tucker, W.B., Weeks, W.F.

31-1995

SEA ICE, DRIFT, ICE DEFORMATION, REMOTE SENSING, SPACEBORNE PHOTOGRAPHY, ACCURACY.

MP 867

UPLAND ASPEN/BIRCH AND BLACK SPRUCE STANDS AND THEIR LITTER AND SOIL PROPERTIES IN INTERIOR ALASKA.

Troth, J.L., et al, *Forest science,* Mar. 1976, 22(1), p.33-44, 17 refs.

Deneke, F.J., Brown, L.

31-1895

ARCTIC LANDSCAPES, TREES (PLANTS), FOREST SOILS, SOIL CHEMISTRY, ALPINE VEGETATION, ALPINE SOILS.

This study characterizes upland forest stands in interior Alaska and compares and contrasts their organic and soil properties. Stand data are presented for tree and sapling species in three aspen/birch and four black spruce stands. Litter layers had greater mass and were more acidic beneath black spruce than beneath aspen/birch. Litter beneath aspen/birch contained higher concentrations of C, N, P, Ca, Mg, Mn, and Zn than did black spruce organic layers. Organic layer K and Fe concentrations were similar beneath the two stand groups. Total organic layer N, P, and Zn mass were similar in the two stand groups, more Ca, Mg, and Mn were present beneath hardwoods, and more K was present beneath black spruce. Extractable soil P decreased rapidly with increasing profile depth beneath aspen/birch stands, but increased with depth to a maximum at or below 15-30 cm beneath hardwoods than beneath coniferous communities. Soils beneath the two stand groups could not be consistently separated by differences in pH, %C, %N, or C/N ratio. Percentage soil carbon at all depths and in all stands was closely correlated with %N (r=0.97) and CEC (r=0.98).

MP 868

FEASIBILITY STUDY OF LAND TREATMENT OF WASTEWATER AT A SUBARCTIC ALASKAN LOCATION.

Sletten, R.S., et al, Hanover, N.H., U.S. Army Cold Regions Research and Engineering Laboratory, 1976, 21p., 10 refs., Presented at the 8th Annual Waste Management Conference, Rochester, N.Y., April 28-30, 1976. Unpublished manuscript.
Uiga, A.
31-1949
WASTE TREATMENT, WATER POLLUTION, SUBARCTIC LANDSCAPES, SUBARCTIC CLIMATE, TESTS, UNITED STATES—ALASKA.

MP 869

LET'S CONSIDER LAND TREATMENT, NOT LAND DISPOSAL.

Howells, D.H., et al, *Civil engineering*, Mar. 1976, 46(3), p.60-62, Comments on J.V. Bentz's paper (see 31-1946).
Uiga, A., Wallace, A.T.
31-1947
WASTE DISPOSAL, WASTE TREATMENT, SEWAGE TREATMENT, WATER POLLUTION, STANDARDS.

MP 870

WASTEWATER REUSE AT LIVERMORE, CALIFORNIA.

Uiga, A., et al, Annual Cornell Agricultural Waste Management Conference, 8th, Rochester, N.Y., April 28-30, 1976. Proceedings, Ann Arbor, Mich., Ann Arbor Science Publishers, 1976, p.511-531, 24 refs.
Iskandar, I.K., McKim, H.L.
31-1493
WATER TREATMENT, WASTE DISPOSAL, SOIL CHEMISTRY.

MP 871

ANALYSIS OF WATER FLOW IN DRY SNOW.

Colbeck, S.C., *Water resources research*, June 1976, 12(3), p.523-527, 12 refs.
31-2958
SNOW PERMEABILITY, WATER RETENTION, WATER FLOW, SNOW THERMAL PROPERTIES, SNOW WATER CONTENT, METAMORPHISM (SNOW), WET SNOW, SNOW HYDROLOGY.

The equations describing water movement in a dry snow cover are derived, and examples of flow through ripe, refrozen, and fresh snows are given. The grain size of snow has a large effect on the timing of water discharge. Water is retained by dry snow to raise its temperature and satisfy the irreducible water saturation. These requirements delay and reduce runoff following rain on dry snow.

MP 872

RED AND NEAR-INFRARED SPECTRAL REFLECTANCE OF SNOW.

O'Brien, H.W., et al, Operational Applications of Satellite Snowcover Observations. The proceedings of a workshop held Aug. 18-20, 1975, Waystation, South Lake Tahoe, Calif, ed. by A. Rango, Washington, D.C., National Aeronautics and Space Administration, 1975, p.345-360, For the same article from a different source see 29-4002. 3 refs.
Munis, R.H.
30-3521
SNOW OPTICS, SNOW COVER DISTRIBUTION, REFLECTIVITY, INFRARED SPECTROSCOPY.

MP 873

USA CRREL SHALLOW DRILL.

Rand, J.H., Ice core drilling, edited by J.F. Splettstoesser, Lincoln, University of Nebraska Press, 1976, p.133-137, 1 ref.
30-3485
ICE CORING DRILLS, DRILLING, FIRN.

The USA CRREL shallow drill is an electromechanical device designed for continuous coring in firn and ice to a depth of 100 m. The drill bores a 14-cm-diameter hole while obtaining a core 10 cm in diameter at a penetration rate up to 1 m/min in -20C ice. The cuttings are transported by spiral brush auger flights to a container above the core-storage section. The core and cuttings are removed from the drill after each 1 m run. Additional components include: 100 m of a seven-conductor electromechanical cable, a 6.8-m tower, a hoist which is ski-mounted, and a three-phase 220-V AC gasoline generator. All the equipment has been designed to be transported in a Twin Otter ski-equipped plane and assembled and operated by two men. The total weight of the drill and associated components is 818 kg. The minimum estimated time required to drill 100 m and retrieve core is 15 hours. Excellent core was obtained in a record drilling time of 15 hr from a 100-m hole drilled in early Nov. at the South Pole under the new geodesic dome. A second 100-m hole was drilled on the Ross Ice Shelf.

MP 874

POLAR ICE-CORE STORAGE FACILITY.

Langway, C.C., Jr., Ice core drilling, edited by J.F. Splettstoesser, Lincoln, University of Nebraska Press, 1976, p.71-75, 8 refs.
30-3482
ICE CORES, COLD STORAGE.

The U.S. Army Cold Regions Research and Engineering Laboratory (USA CRREL) has responsibility for the central storage and curatorial activities of the ice cores recovered in the Office of Polar Programs/National Science Foundation (OPP/NSF) Arctic and Antarctic research programs. The main purpose of the central ice-core storage facility is to handle, process, catalog and distribute the ice cores drilled in the polar regions to OPP-approved recipients for glaciological research. Under the agreement with OPP, the ice cores are stored at CRREL and in a commercial freezer facility at Littletown, N.H.; a technician handles and catalogs them. A core data bank is maintained for retrieval and information exchange, and starting with the Dye 3 ice core, is being computerized. The storage facilities are described. Recent developments include a cooperative analysis program between CRREL, the University of Copenhagen, and the University of Bern, a particle analysis lab., a core stratigraphy and logging routine, and a surface pit/ice-core correlation system.

MP 875

HOVERCRAFT GROUND CONTACT DIRECTIONAL CONTROL DEVICES.

Abele, G., International Hovering Craft, Hydrofoil and Advanced Transit Systems Conference, 2nd, Amsterdam, May 17-20, 1976. Proceedings, London, Kalerglic Publications, 1976, p.51-59, 6 refs.
31-1996
ALL TERRAIN VEHICLES, AIR CUSHION VEHICLES, VEHICLE WHEELS, ENVIRONMENTAL IMPACT, TUNDRA TERRAIN, IMPACT.

The maneuverability of a hovercraft can become a serious operational problem where the craft's travel route is restricted by obstacles or requires close-quarter turns, and during travel on slopes and in crosswind conditions. While improvement and perfection of aerodynamic methods may be a more desirable approach, there is a practical limit to these methods, and the use of ground contact devices requires consideration to provide more positive directional control. Wheels deserve special attention, and therefore are analyzed in more detail because of their obvious application on a variety of land terrains. Brake rods and harrows are more suitable on water, ice and snow. The saucer would cause the least ecological impact on fragile organic terrains such as tundra. The use of controlled ground contact with skirt sections having retractable rollers or special wearing surfaces may represent the least significant change to the basic design of the craft or its components. The relative directional stability is evaluated in terms of the total yawing moments produced by a variety of wheel arrangements (single, dual, tandem), location on the craft, and operational modes (free-rolling, braked, or a combination of the two). The available moments are plotted against the yaw angle of the craft to determine the most effective operational mode with a particular wheel arrangement for any yaw condition. The analysis is limited to retractable devices which act as moment-producing brakes or rollers and do not serve as either propulsion or load support aids.

MP 876

SPREAD OF CETYL-1-C14 ALCOHOL ON A MELTING SNOW SURFACE.

Meiman, J.R., et al, *International Association of Scientific Hydrology. Bulletin*, Sep. 1966, 11(3), p.5-8, 3 refs. Microform No. SIP 25051.
Slaughter, C.W.
31-3141
SNOW SURFACE, SNOW PERMEABILITY, SNOW MELTING, DISTRIBUTION, SNOW EVAPORATION.

The primary objective of the study was to gain information on the rate of spread of cetyl alcohol on a melting snow surface. Point applications of radioactive cetyl-1-C14 alcohol were placed on the surface of snow contained in cubical wooden boxes 25 cm on each side. The boxes with snow were placed in a controlled environment of 2C and with a relative humidity of 95%. Under the study conditions, cetyl alcohol spread as far as 10 cm within 1 hr and 15 min. Distribution of the alcohol over the surface was highly variable. (Auth.)

MP 878

FIRE IN THE NORTHERN ENVIRONMENT-A SYMPOSIUM.

Slaughter, C.W., ed, Portland, Oregon, U.S. Pacific Northwest Forest and Range Experiment Station, 1971, 275p., Numerous refs. passim.
Barney, R.J., ed, Hansen, G.M., ed.
26-2733
FOREST FIRES, FIRES, ENVIRONMENTAL IMPACT, PERMAFROST, TAIGA.

Comprised of 21 papers on fire, its control and effects on the Alaska environment.

MP 879

ON THE DETERMINATION OF HORIZONTAL FORCES A FLOATING ICE PLATE EXERTS ON A STRUCTURE.

Kerr, A.D., *Journal of glaciology*, 1978, 20(82), p.123-134, 26 refs.
32-4451
ICE PRESSURE, ICE LOADS, ICE COVER STRENGTH, STRUCTURES, LOADS (FORCES), FLOATING ICE.

At first, the general approach for calculating the horizontal forces an ice cover exerts on structures is discussed. Ice-force determination consists of two parts: (1) the analysis of the in-plane forces, assuming that the ice cover remains intact; and (2) the use of a failure criterion, because an ice force cannot be larger than the force capable of breaking up the ice cover. For an estimate of the largest ice force, an elastic plate analysis and a failure criterion are often sufficient. A review of the literature revealed that in the majority of the analyses, it is assumed that the failure load is directly related to a "crushing strength" of the ice cover. Observations in the field and tests in the laboratory show, however, that in some instances the ice cover failed by buckling. Subsequently, the ice-force analyses based on the buckling failure mechanism are reviewed, and their shortcomings are pointed out. A new method of analysis, which is based on the buckling of a floating ice wedge, is then presented.

MP 880

TUNDRA BIOME APPLIES NEW LOOK TO ECOLOGICAL PROBLEMS IN ALASKA.

Brown, J., *Northern engineer*, Summer 1970, 2(2), p.9.
31-4048
ECOSYSTEMS, ENVIRONMENTS, TUNDRA BIOME, ENVIRONMENTAL PROTECTION, RESEARCH PROJECTS, ARCTIC REGIONS, UNITED STATES—ALASKA.

MP 881

TUNDRA BIOME PROGRAM.

Brown, J., *Science*, Feb.27, 1970, Vol.167, p.1278.
31-4049
ECOSYSTEMS, ENVIRONMENTS, TUNDRA BIOME, RESEARCH PROJECTS.

MP 882

HEAT TRANSFER BETWEEN A FREE WATER JET AND AN ICE BLOCK HELD NORMAL TO IT.

Yen, Y.-C., *Letters in heat and mass transfer*, Jul/Aug. 1976, 3(4), p.299-307, 2 refs.
31-242
HEAT TRANSFER COEFFICIENT, ICE MELTING, HYDRAULIC JETS, NOZZLES.

MP 883

GENERATION OF RUNOFF FROM SUBARCTIC SNOWPACKS.

Dunne, T., et al, *Water resources research*, Aug. 1976, 12(4), P.677-685, 13 refs.
Price, A.G., Colbeck, S.C.
31-773
SNOW COVER, RUNOFF, MODELS, CANADA—LABRADOR.

A physically based model of the movement of water through snowpacks was used to calculate hydrographs generated by diurnal waves of snowmelt on the tundra and in the boreal forest of subarctic Labrador. The model was tested against measured hydrographs from hillside plots that sampled a range of aspect, gradient and length, vegetative cover, and snow depth and density. The model yielded good results, particularly in the prediction of peak runoff rates, though there was a slight overestimate of the lag time. A comparison of predictions with field measurements indicated that given the ranges over which each of the controls is likely to vary, the two most critical factors controlling the hydrograph are the snow depth and the melt rate, which must be predicted precisely for short time intervals. Permeability of the snowpack is another important control, but it can be estimated closely from published values.

MP 884

BEARING CAPACITY OF FLOATING ICE PLATES SUBJECTED TO STATIC OR QUASI-STATIC LOADS.

Kerr, A.D., *Journal of glaciology*, 1976, 17(76), p.229-268, Bibliography p. 263-268, In English with French and German summaries.
31-786
FLOATING ICE, BEARING STRENGTH, STATIC LOADS, BIBLIOGRAPHIES.

This paper contains a critical survey of the literature on the bearing capacity of floating ice plates. It consists of a discussion of general questions, a critical survey of analytical attempts to determine the bearing capacity of floating ice plates and a survey of field and laboratory tests on floating ice plates and their relation to the analytical results. It concludes with a systematic summary of the results, a discussion of observed shortcomings, and suggestions for needed investigations.

MP 885
SUBSURFACE EXPLORATIONS IN PERMAFROST AREAS.
Case, J.R., Jr., *American Society of Civil Engineers. Soil Mechanics and Foundation Division. Journal,* Oct. 1959, 85(SM5), p.31-41, See also SIP-17852. Discussion by H.W. Stevens and W.P. Verville, Ibid., June 1960, 86(SM3), p.63-67. 10 refs.
Stevens, H.W., Verville, W.P.
31-1874
PERMAFROST SAMPLERS, SUBSURFACE INVESTIGATIONS, CORE SAMPLERS, FROZEN GROUND, DRILLING.

Soil sampling techniques used in two subsurface investigation programs undertaken in the Arctic are described and compared. Since the methods used were only partially successful in recovering samples for field testing, recommendations are made for the development of boring procedures which should prove to be more satisfactory.

MP 886
PORTABLE INSTRUMENT FOR DETERMINING SNOW CHARACTERISTICS RELATED TO TRAFFICABILITY.
Parrott, W.H., et al, International Conference on Terrain-Vehicle Systems, 4th, Stockholm, April 24-28, 1972. Proceedings. Vol.2, Stockholm, Sweden, 1972, p.193-204, 7 refs.
Ueda, H.T., Abele, G.
31-1796
SNOW STRENGTH, SNOW COVER STABILITY, MEASURING INSTRUMENTS, TRAFFICABILITY, SHEAR PROPERTIES.

A new, portable one-man operated instrument was developed to simplify the measuring of snow properties required for evaluating the trafficability of a snow cover and to predict vehicle performance. The 16-lb instrument with interchangeable plates of various sizes is capable of providing data for computing the vertical strength parameters n and k and the horizontal strength parameters c and /. The vertical load is applied manually, the predetermined contact pressures are indicated by a system of signal lights connected to a force control switch type force gage, the manually (push-button) activated torque motor for the shear test is driven by a 12-volt battery. A second man is needed to record sinkage and torque data during the test.

MP 887
SOME EFFECTS OF AIR CUSHION VEHICLE OPERATIONS ON DEEP SNOW.
Abele, G., et al, International Conference on Terrain-Vehicle Systems, 4th, Stockholm, April 24-28, 1972. Proceedings. Vol.2, Stockholm, Sweden, 1972, p.214-241, 2 refs.
Parrott, W.H.
31-1798
AIR CUSHION VEHICLES, SNOW DEPTH, EROSION, SURFACE PROPERTIES, TESTS.

Travel with an SK-5 ACV over soft snow results in surface deformation/erosion of a few inches, caused primarily by rear skirt drag; on windswept snow only scratches can be seen. During hovering on soft snow, deformation below the cushion chamber usually does not exceed a few inches. The action of the air flow (escape velocity 70 to 120 ft/sec) produces a 1-ft ditch below the peripheral skirt in less than a minute; thereafter the extent of erosion does not increase appreciably during continued hovering. A partial seal between the inner face of the skirt (above fingers) and the snow surface may exist, arresting further settling of the vehicle. Relatively cohesive layers of snow such as windslabs and crusts are not eroded. A level snow cover, regardless of how deep or soft, does not appear to be capble of immobilizing an ACV of this and larger size. Some operational problems and their degree of severity, such as visibility, snow accumulation and adhesion to vehicle, skirt drag, effect of terrain surface porosity and presence of vegetation, are also discussed.

MP 888
ICE REMOVAL FROM THE WALLS OF NAVIGATION LOCKS.
Frankenstein, G.E., et al, Symposium on Inland Waters for Navigation, Flood Control and Water Diversions, Colorado State University, August 10-12, 1976. Proceedings, 1976, p.1487-1496, 4 refs.
Wuebben, J.L., Jellinek, H.H.G., Yokota, R.
31-1800
ICE REMOVAL, WALLS, CHANNELS (WATERWAYS), ICE PREVENTION, PROTECTIVE COATINGS, ICE NAVIGATION, ICE ADHESION, DEICING.

MP 889
20-YR OSCILLATION IN EASTERN NORTH AMERICAN TEMPERATURE RECORDS.
Mock, S.J., et al, *Nature,* June 10, 1976, 261(5560), p.484-486, 8 refs.
Hibler, W.D., III.
31-1801
AIR TEMPERATURE, PERIODIC VARIATIONS, SOLAR ACTIVITY, METEOROLOGICAL DATA.

MP 890
APPLICATIONS OF THERMAL ANALYSIS TO COLD REGIONS.
Sterrett, K.F., Roundtable Discussion on Thermal Analysis Techniques, Cincinnati, Ohio, June 1976. Proceedings, 1976, p.167-181, 15 refs.
31-1802
THERMAL ANALYSIS, FROZEN GROUND PHYSICS, UNFROZEN WATER CONTENT, CLAY MINERALS, ICE WATER INTERFACE, LOW TEMPERATURE TESTS.

The author discusses the low temperature behavior of several samples of frozen soils taken from the dry valleys of Antarctica. The samples were composed of various clay minerals and had varying water contents. It is demonstrated that some of the water remains unfrozen and that there is a dependency between the unfrozen portion and the surface area of the sample. It was pointed out that problems arising from the unfrozen water content of soils are of great interest to CRREL researchers as is the analysis of ice cores from Greenland and Antarctica as a technique for establishing past climates and in predicting future climates.

MP 891
OVERVIEW OF LAND TREATMENT FROM CASE STUDIES OF EXISTING SYSTEMS.
Uiga, A., et al, Hanover, N.H., U.S. Army Cold Regions Research and Engineering Laboratory, 1976, 26p., Presented at the 49th Annual Water Pollution Control Federation Conference, Minneapolis, Minnesota, 4-8 October 1976. 16 refs.
Sletten, R.S.
31-1803
WASTE TREATMENT, WATER TREATMENT, WATER POLLUTION, SOIL CHEMISTRY, COST ANALYSIS, CLIMATIC FACTORS.

Wastewater treatment by land application is described for sites at Calumet, Michigan (88 years); Quincy, Washington (20 years); Manteca, California (11 years); and Livermore, California (8 years). All sites meet on an average the USPHS drinking water limit of 10 mg/l for NO3-N. Preapplication treatments vary for the site: Calumet, undisinfected, no treatment; Quincy, undisinfected, primary treatment; Manteca, undisinfected, secondary treatment; and Livermore, disinfected, secondary treatment. The preapplication treatment and total operation and maintenance costs are: 3c/1000 gallons for Calumet, 20c/1000 gallons for Quincy, 27c/1000 gallons for Manteca, 35c/1000 gallons for Livermore. Although minor individual site problems are discussed and solutions presented, the authors conclude that land application offers year round treatment alternatives within variable climates.

MP 892
LIFE-CYCLE COST EFFECTIVENESS OF MODULAR MEGASTRUCTURES IN COLD REGIONS.
Wang, L.R.-L., et al, International Symposium on Housing Problems, Atlanta, Georgia, May 24-28, 1976, 1976, p.760-776, 7 refs.
Tobiasson, W.
31-1804
RESIDENTIAL BUILDINGS, COLD WEATHER CONSTRUCTION, CONSTRUCTION COSTS, ARCTIC CLIMATE, WINTER MAINTENANCE, STRUCTURES.

MP 893
ICE ENGINEERING COMPLEX ADOPTS HEAT PUMP ENERGY SYSTEM.
Aamot, H.W.C., *Energy international,* Jan 1977, 14(1), p.25-26, Comments p.3.
31-1805
HEAT RECOVERY, HEATING, COOLING SYSTEMS, HEAT TRANSFER, TRANSITION HEATING, PUMPS.

MP 894
ARCTIC TRANSPORTATION: OPERATIONAL AND ENVIRONMENTAL EVALUATION OF AN AIR CUSHION VEHICLE IN NORTHERN ALASKA.
Abele, G., et al, American Society of Mechanical Engineers, 1976, 7p., Presented at the Petroleum Mechanical Engineering and Pressure Vessels and Piping Conference, Mexico City, Mexico, September 19-24, 1976. Paper No.76-Pet-41. 8 refs.
Brown, J.
31-1845
AIR CUSHION VEHICLES, TRAFFICABILITY, COST ANALYSIS, ENVIRONMENTAL IMPACT, REVEGETATION, ARCTIC TERRAIN, TESTS.

Traffic tests conducted near Barrow, Alaska with a 7-ton SK-5 Air Cushion Vehicle have shown that these types of vehicles can provide year-round high-speed transport capability over a variety of relatively level, low strength terrains. The ecological impact of ACV traffic over easily degradable tundra terrains is not nearly as significant as that of wheeled or tracked vehicle traffic.

MP 895
CIRCULATION AND SEDIMENT DISTRIBUTION IN COOK INLET, ALASKA.
Gatto, L.W., *Alaska. University. Institute of Marine Science. Occasional Publication,* 1976, No.4, Assessment of the Arctic marine environment, edited by D.W. Hood, D.C. Burrell, and E. Kelley. Based on a symposium held in conjunction with Third International Conference on Port and Ocean Engineering Under Arctic Conditions, POAC-75, held in Fairbanks, Alaska, Aug. 11-15, 1975., p.205-227, 18 refs.
31-1935
SEDIMENT TRANSPORT, WATER FLOW, SEA ICE DISTRIBUTION, SPACEBORNE PHOTOGRAPHY, OCEAN CURRENTS, UNITED STATES —ALASKA—COOK INLET.

The purpose of this investigation was to analyze surface circulation, suspended sediment distribution, water-type migration, and tidal flushing mechanisms, utilizing medium and high altitude aircraft and repetitive synoptic satellite imagery with corroborative ground truth data. LANDSAT-1 and -2 and NOAA-2 and -3 imagery provided observations of surface currents, water type migrations and sediment and sea ice distributions during different seasons and tides. NASA NP-3A and U-2 aircraft multispectral imagery was used to analyze coastal processes, i.e., currents and sediment dispersion in selected areas. Ground truth data were utilized in the interpretation of the aircraft and satellite imagery and verified many of the regional circulation patterns inferred from the suspended sediment patterns apparent on the imagery. Several local circulation patterns not previously reported were identified.

MP 896
RECLAMATION OF WASTEWATER BY APPLICATION ON LAND.
Iskandar, I.K., et al, Hanover, N.H., U.S. Army Cold Regions Research and Engineering Laboratory, 1976, 15p., Presented at the U.S. Army Science Conference, Research Triangle Park, North Carolina, June 1976. 23 refs.
Leggett, D.C.
31-1901
WASTE TREATMENT, WATER TREATMENT, WATER CHEMISTRY, SEEPAGE, SOIL CHEMISTRY, WASTE DISPOSAL.

The capacity of a slow infiltration land treatment system to renovate wastewater in cold regions was investigated using six outdoor test cells. The principal mechanisms for nitrogen removal were found to be plant uptake and denitrification; phosphorus was removed by plant uptake and immobilization in the surface soil layer; heavy metals were removed by sorption or precipitation in the top few centimeters of soil. Nitrogen removal was found to be seasonally dependent, the greatest losses occurring in the spring and summer and the least during fall and winter. This was due to the absence of plant uptake during winter and the effect of temperature on the conversion of ammonium to nitrate nitrogen (nitrification), which caused significant amounts of NH4 to be stored during winter and released in spring, giving rise to a period of high NO3 concentration in the leachate. Application of 15 cm/wek of secondary effluent to sandy loam soil resulted in diminished water quality (>10 mg/l of nitrate-N) during most of the year. With the exception of this heavy treatment experiment, heavy metals and phosphorus were confined to the top 15 cm of the soil. Application of effluents containing ppm levels of heavy metals to forages did not appear to cause phytotoxic effects. As for other water quality parameters (organic-C, BOD, suspended solids, fecal coliform) renovation of the wastewater was essentially complete.

MP 897
DEVELOPMENT OF A REMOTE-READING TENSIOMETER/TRANSDUCER SYSTEM FOR USE IN SUBFREEZING TEMPERATURES.
McKim, H.L., et al, Conference on Soil-Water Problems in Cold Regions, 2nd, Edmonton, Sep. 1976, Proceedings, 1976, p.31-45, 18 refs.
Berg, R.L., McGaw, R., Atkins, R.T., Ingersoll, J.
31-1905
SOIL WATER, VAPOR PRESSURE, MEASURING INSTRUMENTS, SOIL FREEZING, FREEZE THAW TESTS, REMOTE SENSING.

MP 898
GALERKIN FINITE ELEMENT ANALOG OF FROST HEAVE.
Guymon, G.L., et al, Conference on Soil-Water Problems in Cold Regions, 2nd, Edmonton, Sep. 1976, Proceedings, 1976, p.111-113, 3 refs.
Berg, R.L.
31-1911
FROST HEAVE, MATHEMATICAL MODELS.

MP 899

SIMPLE PROCEDURE TO CALCULATE THE VOLUME OF WATER REMAINING UNFROZEN IN A FREEZING SOIL.

McGaw, R., et al, Conference on Soil-Water Problems in Cold Regions, 2nd, Edmonton, Sep. 1976, Proceedings, 1976, p.114-122, 6 refs.
Tice, A.R.
31-1912
FROZEN GROUND PHYSICS, SOIL FREEZING, UNFROZEN WATER CONTENT.

MP 900

SEASONAL VARIATIONS IN APPARENT SEA ICE VISCOSITY ON THE GEOPHYSICAL SCALE.

Hibler, W.D., III, et al, *Geophysical research letters,* Feb. 1977, 4(2), p.87-90, 12 refs.
Tucker, W.B.
31-3240
SEA ICE, VISCOSITY, DRIFT, ICE GROWTH, ICE PHYSICS, VISCOUS FLOW, SEASONAL VARIATIONS.

Using available atmospheric pressure and ocean current data and estimating non-local stress transferral through the ice cover by employing a viscous drift model in the infinite boundary limit, predicted drift rates for one Russian and two U.S. drifting stations are made over the time period May 1962 to April 1964. The viscosity values giving the best fit between observed and predicted values show a pronounced winter increase that correlates well with the ice growth rate. Phsically this suggests that ice drift rates (for a given wind field) tend to decrease in winter because of increased stress transferral through the ice cover. An empirical linear relationship between viscosity and ice growth rate is derived which yields predictions in reasonable agreement with both long (yearly) and short term (monthly) observed drift rates.

MP 901

SEGREGATION-FREEZING TEMPERATURE AS THE CAUSE OF SUCTION FORCE.

Takagi, S., International Symposium on Frost Action in Soils, Luleå, Sweden, Feb. 1977. Proceedings, Vol.1, University of Luleå, 1977, p.59-66, 17 refs.
31-2067
GROUND ICE, ICE LENSES, SOIL WATER MIGRATION, FROZEN GROUND THERMODYNAMICS, SOIL PRESSURE.

A new freezing mechanism, called segregation freezing, is proposed, to explain the generation of the suction force that draws pore water up to the freezing surface of a growing ice lens. The segregation-freezing temperature is derived by applying thermodynamics to soil mechanics concept that distinguishes the mechanically effective pressure from the mechanically neutral pressure. The frost-heaving pressure appears in the solution of the differential equations for the simultaneous flow of heat and water, of which the segregation-freezing temperature is one of the boundary conditions.

MP 902

PERIODIC STRUCTURE OF NEW HAMPSHIRE SILT IN OPEN-SYSTEM FREEZING.

McGaw, R., International Symposium on Frost Action in Soils, Luleå, Sweden, Feb. 1977. Proceedings, Vol.1, University of Luleå, 1977, p.129-136, 2 refs.
31-2074
SOIL FREEZING, SOIL STRUCTURE, WATER TABLE, GROUND ICE.

The periodic frozen structure of a glacially-deposited silt soil is analyzed using a metric grouping of sizes. Four specimens were frozen simultaneously in open-system freezing with initial water tables ranging from 15 cm (6 in.) to 105 cm (42 in.). Rate of freezing varied from near zero to 0.80 mm/hr. Measurements on the average thickness of individual ice layers and residual soil layers are tabulated and graphed for each specimen, with water-table depth and rate-of-freezing as independent variables. The data show that the ice-layer thickness decreases continuously with freezing rate for each of the four water-table depths. The maximum ice-layer thickness (4.5 mm) occurred with the highest water table and the slowest freezing. In contrast, the residual soil layer develops a maximum thickness for this soil in the 0.30 to 0.40 mm/hr range of freezing rates. The peak value (2.5 mm) occurred with water table depths of 45 cm (18 in.) and 75 cm (30 in.). In addition, the two specimens with the highest water tables developed a major secondary peak at very slow rates of freezing (less than 0.10 mm/hr), giving evidence of a separate mode of freezing.

MP 903

CARBON DIOXIDE DYNAMICS ON THE ARCTIC TUNDRA.

Coyne, P.I., et al, International Biological Program. Tundra Biome. Structure and function of the tundra ecosystem. Vol.1, Progress report and proposal abstracts. 1971, p.48-52.
Kelley, J.J.
31-2097
TUNDRA VEGETATION, CARBON DIOXIDE, SNOW COVER EFFECT.

MP 904

SEASONAL CYCLES AND RELATIVE LEVELS OF ORGANIC PLANT NUTRIENTS UNDER ARCTIC AND ALPINE CONDITIONS.

McCown, B.H., et al, International Biological Program. Tundra Biome. Structure and function of the tundra ecosystem. Vol.1, Progress report and proposal abstracts. 1971, p.55-57.
Tieszen, L.L.
31-2099
TUNDRA VEGETATION, SEASONAL VARIATIONS, PLANT PHYSIOLOGY.

MP 905

ECOLOGICAL EFFECTS OF OIL SPILLS AND SEEPAGES IN COLD-DOMINATED ENVIRONMENTS.

McCown, B.H., et al, International Biological Program. Tundra Biome. Structure and function of the tundra ecosystem. Vol.1, Progress report and proposal abstracts. 1971, p.61-65.
Brown, J., Tieszen, L.L.
31-2101
TUNDRA SOILS, TUNDRA VEGETATION, OIL SPILLS, DAMAGE, ENVIRONMENTAL IMPACT.

MP 906

ABIOTIC OVERVIEW.

Weller, G., et al, International Biological Program. Tundra Biome. Structure and function of the tundra ecosystem. Vol.1, Progress report and proposal abstracts. 1971, p.173-181.
Brown, J.
31-2114
RESEARCH PROJECTS, TUNDRA, MICROCLIMATOLOGY, SOIL TEMPERATURE, MODELS, BOUNDARY LAYER, SNOW COVER EFFECT, VEGETATION PATTERNS.

MP 907

PREDICTION AND VALIDATION OF TEMPERATURE IN TUNDRA SOILS.

Brown, J., et al, International Biological Program. Tundra Biome. Structure and function of the tundra ecosystem. Vol.1, Progress report and proposal abstracts. 1971, p.193-197.
Nakano, Y.
31-2116
TUNDRA SOILS, SOIL TEMPERATURE, THAW DEPTH, MATHEMATICAL MODELS, FORECASTING.

MP 908

TRACE GAS ANALYSIS OF ARCTIC AND SUBARCTIC ATMOSPHERE.

Murrmann, R.P., International Biological Program. Tundra Biome. Structure and function of the tundra ecosystem. Vol.1, Progress report and proposal abstracts. 1971, p.199-203.
31-2118
ATMOSPHERIC COMPOSITION, GASES.

MP 909

U.S. TUNDRA BIOME CENTRAL PROGRAM 1971 PROGRESS REPORT.

Brown, J., International Biological Program. Tundra Biome. Structure and function of the tundra ecosystem. Vol.1, Progress report and proposal abstracts. 1971, p.244-270.
31-2121
RESEARCH PROJECTS.

MP 910

SEA ICE CONDITIONS IN THE ARCTIC.

Weeks, W.F., *Arctic Ice Dynamics Joint Experiment. AIDJEX bulletin,* Dec. 1976, No.34, p.173-205, Includes, as Appendix 1, a section on Ice Terminology. 24 refs.
31-2291
ICE CONDITIONS, SEASONAL VARIATIONS, TERMINOLOGY, ICE PHYSICS, DRIFT.

MP 911

PROCEEDINGS.

Colloquium on Water in Planetary Regoliths, Hanover, N.H., October 5-7, 1976, Hanover, N.H., U.S. Army Cold Regions Research and Engineering Laboratory, 1977, 161p., Refs. passim. For selected papers see 31-2494 through 31-2511.
31-2493
EXTRATERRESTRIAL ICE, PERMAFROST HYDROLOGY, SOIL WATER, ICE SPECTROSCOPY.

MP 912

MARS SOIL-WATER ANALYZER: INSTRUMENT DESCRIPTION AND STATUS.

Anderson, D.M., et al, Colloquium on Water in Planetary Regoliths, Hanover, N.H., Oct. 5-7, 1976. Proceedings, Hanover, N.H., U.S. Army Cold Regions Research and Engineering Laboratory, 1977, p.149-158, 9 refs.
Stephens, J.B., Fanale, F.P., Tice, A.R.
31-2511
MARS (PLANET), SOIL WATER, EXTRATERRESTRIAL ICE, PERMAFROST HYDROLOGY, MEASURING INSTRUMENTS, RADIOMETRY, PERMAFROST SAMPLERS.

MP 913

APPLICATIONS OF REMOTE SENSING FOR CORPS OF ENGINEERS PROGRAMS IN NEW ENGLAND.

McKim, H.L., et al, International Symposium on Remote Sensing of Environment, 10th, Ann Arbor, Oct. 6-10, 1975, Ann Arbor, Environmental Research Institute of Michigan, 1975, 8p. + 14 figs. and tables, 8 refs.
Merry, C.J., Cooper, S., Anderson, D.M., Gatto, L.W.
31-3652
REMOTE SENSING, AERIAL SURVEYS, SPACEBORNE PHOTOGRAPHY, ENVIRONMENTS, UNITED STATES—NEW ENGLAND.

The utility of satellite, high altitude and low altitude aerial imagery is presently being critically evaluated by the Corps of Engineers. The most significant contribution to date has been to increase confidence limits by more accurately estimating parameters used in models. Within the last three years several new cooperative remote sensing programs addressing environmental and hydrologic problems have been implemented. The objectives of these programs were to determine the availability, type, scale and resolution required and to show how remote sensing methods can be utilized to augment or update conventional procedures. Imagery from LANDSAT mission provided valuable information for site evaluation, definition of geologic lineations and monitoring snow and ice accumulation and ablation. The Skylab program has defined the detail of land use mapping that can be accomplished from the S190A and S190B photography. Low altitude aircraft photography (scale 1:33,600) was used to determine the location of materials at a potential dam construction site which could allow a large cost saving for transportation of material as compared to original design estimates. In another program, the effect of inundation at six New England flood control reservoirs was investigated. The extent and severity of tree damage were mapped and analyzed statistically. These results will be used by the Corps in the reservoir management program.

MP 914

EVALUATION AND RECOMMENDATIONS FOR SNOWDRIFT CONTROL AT FAA ILS FACILITIES, BARROW AND DEADHORSE, ALASKA, FINAL REPORT.

Calkins, D.J., *U.S. National Aviation Facilities Experimental Center. Report,* Sep. 1976, FAA-NA-76-165, 41p., ADA-030 401.
31-2585
SNOWDRIFTS, SNOW FENCES, UNITED STATES—ALASKA—BARROW, UNITED STATES—ALASKA—DEADHORSE.

The existing snowdrifting conditions are described at the Barrow and Deadhorse airfields and recommendations made for minimizing the drifting snow at the ILS facilities. The problem of drifting snow at the localizer and glide slope facilities was a result of the structures themselves creating drifts and causing outages. The most economical method of eliminating the problem at the glide slope was relocation of the instrument shelters such that they are not in line with the antenna masts and the prevailing wind direction. The localizer snowdrifts were caused by the bulkiness of the supporting structure carrying the antenna; although it is elevated on piles severe turbulence develops behind the structure and the snow deposits. Wooden snowfences, 10 ft high, in parallel rows 200 ft apart will control the snow during an average snow year. Model studies of each alternative method were carried out to validate the various proposals. (Auth.)

MP 915

VAPOR PRESSURE OF 2,4,6-TRINITROTOLUENE BY A GAS CHROMATOGRAPHIC HEADSPACE TECHNIQUE.

Leggett, D.C., *Journal of chromatography,* 1977, Vol.133, p.83-90, 23 refs.
31-2565
VAPOR PRESSURE, GAS CHROMATOGRAPHY, TRINITROTOLUENE.

The vapor pressure of 2,4,6-trinitrotoluene was determined by a gas chromatographic headspace technique. The vapor pressure from 12-40C was derived from the experimental data using the ideal gas law and then compared to extrapolations of literature data obtained by the Knudsen effusion technique. Excellent agreement was obtained. Advantages of the chromatographic headspace method over the effusion method were: (1) scrupulous purity was found to be unnecessary since volatile impurities were chromatographically separated from the compound of interest, (2) the method was highly sensitive using an electron capture detector, and (3) the method was experimentally simple, requiring materials that are readily available, i.e., a gas chromatograph, a temperature bath, a few septum-capped bottles, and gas-tight syringes.

MP 916
ON THE ORIGIN OF PINGOS—A COMMENT.
Mackay, J.R. *Journal of hydrology (Amsterdam)*, 1976, Vol.30, p.295-298, Comment to H. Ryckborst's paper (see 31-2549). 10 refs.
31-2679
PINGOS, GROUND ICE, SOIL WATER, SUBSURFACE STRUCTURES, ACTIVE LAYER, PERMAFROST HYDROLOGY, ICE LENSES, ORIGIN.

MP 917
HIGH-LATITUDE BASINS AS SETTINGS FOR CIRCUMPOLAR ENVIRONMENTAL STUDIES.
Slaughter, C.W., et al, Circumpolar Conference on Northern Ecology, Ottawa, Sep. 15-18, 1975. Proceedings, Ottawa, National Research Council. Canada, 1975, p.IV/57-IV/68, 48 refs., In English with French summary.
Santeford, H.S.
31-2564
RESEARCH PROJECTS, WATERSHEDS, ENVIRONMENTS, INTERNATIONAL COOPERATION.

Much environmental research (both small scale and large) may logically be conducted within the larger context of entire drainage basins—Research Watersheds. These are catchments which represent major environmental settings (e.g., Arctic tundra, subarctic taiga) and are specifically dedicated to research. The hydrologic cycle of a complete catchment considered from precipitation through basin yield provides a functional and conceptual base for considering mass, nutrient, and energy transfer questions relevant to ecosystem functioning. With proper planning and execution, advantages to be gained may include: economy of effort, better cooperation between disciplines, improved application of results to real-world problems, and enhanced potential for comparative studies among circumpolar settings. In high latitudes, where climate, transportation and logistics, available scientific manpower, and lack of good background data often combine to render research both difficult and expensive, increased efficiency through integration of complementary biological and physical studies is especially attractive. In 1974-75 a start was made toward such a circumpolar program. Through the International Hydrological Decade (IHD), initial meetings of Swedish, Canadian, and U.S. scientists have considered objectives of facilitating communication and data exchange, and ultimately improving understanding of hydrologic functioning in high-latitude environments. In Alaska the 104-sq-km Caribou-Poker Creeks Research Watershed provides one example of multi-disciplinary, multi-agency research into environmental and hydrological behaviour of subarctic uplands, with provision for physical and biological investigations and experimentation. Similar circumpolar efforts should prove useful in a wide variety of discipline-specific and integrated scientific efforts.

MP 918
SEA ICE PROPERTIES AND GEOMETRY.
Weeks, W.F., *Arctic Ice Dynamics Joint Experiment. AIDJEX bulletin*, Dec. 1976, No.34, p.137-171, Refs. p 167-171.
31-2290
SEA ICE, ICE MECHANICS, ICE PHYSICS, ICE STRENGTH, ICE COVER THICKNESS, PRESSURE RIDGES.

MP 919
DELINEATION AND ENGINEERING CHARACTERISTICS OF PERMAFROST BENEATH THE BEAUFORT SEA.
Sellmann, P.V., et al. Environmental assessment of the Alaskan Continental Shelf, Vol.4. Principal investigators' reports July-September 1976, Boulder, Colorado, Environmental Research Laboratories, 1976, p.53-60, 3 refs.
Berg, R.L., Brown, J., Blouin, S.E., Chamberlain, E.J., Iskandar, A., Ueda, H.T.
31-2621
OFFSHORE DRILLING, DRILL CORE ANALYSIS, ENGINEERING GEOLOGY, SUBSEA PERMAFROST.

MP 920
LAND TREATMENT OF WASTEWATER—CASE STUDIES OF EXISTING DISPOSAL SYSTEMS AT QUINCY, WASHINGTON AND MANTECA, CALIFORNIA.
Murrmann, R.P., et al, Waste Management Conference, 8th, Rochester, N.Y., April 28-30, 1976. Proceedings, Rochester, N.Y., 1976, 36p., 21 refs.
Iskandar, I.K.
31-3656
WASTE TREATMENT, WATER TREATMENT, SOIL CHEMISTRY, WATER CHEMISTRY, IRRIGATION, UNITED STATES—WASHINGTON—QUINCY, UNITED STATES—CALIFORNIA—MANTECA.

Evaluations of long-term systems for wastewater disposal on land by slow infiltration at Manteca, California, and Quincy, Washington, are presented. Factors considered include site history, operational characteristics, current performance and impact on soil characteristics. Domestic undisinfected wastewater has been applied at these locations by flood irrigation for up to 20 years. At Manteca, forage vegetation (rye grass) has been continuously maintained while at Quincy a crop rotation has been practiced. The system at Quincy has been relatively heavily loaded by application of approximately 15 cm/A (6 in./A) per week while at Manteca an average of only 4.5 cm/A (1.8 in./A) of wastewater has been applied per week. At both sites a control field and two disposal fields were investigated for comparison. Representative soil samples were collected at intervals to a depth of 150 cm. These were analyzed for about 30 pertinent chemical parameters including total and plant-available heavy metals. Soil solution samples were collected at 80- and 160-cm depths with suction lysimeters. Pretreatment water samples, peripheral drainage water and ground water samples were also collected. All water samples were analyzed in the fields for pH, NH4-N, NO3-N and ortho-P during three periods in 1974.

MP 921
PROPOSED SIZE CLASSIFICATION FOR THE TEXTURE OF FROZEN EARTH MATERIALS.
McGaw, R., 1975, 10p., Presented at Les problèmes posés par la gélifraction. Recherches fondamentales et appliquées. Colloque interdisciplanaire, Paris-Le Havre, 23-25 April, 1975. Report No.311. 4 refs.
32-626
FROZEN GROUND, SOIL STRUCTURE, CLASSIFICATIONS, GROUND ICE.

The macroscopic fabric, or texture, of frozen earth materials represents a point-by-point summation of the microscopic nucleation, moisture flow, and heat flow around and between individual mineral particles. As such, frozen texture is intimately related to the basic mechanisms of ice segregation. A study of the details of frozen texture can lead to fundamental new knowledge on the formation and structural effects of segregated ice. A size classification derived from laboratory tests is proposed for the systematic measurement of the characteristic (banded) element of interleaved soil and ice in fine-grained granular materials. Graphs are presented showing the relationship between the frozen texture of New Hampshire Silt and measured values of freezing rate as determined by the 0 C isotherm.

MP 922
DYNAMICS OF NEAR-SHORE ICE.
Weeks, W.F., et al, Environmental assessment of the Alaskan Continental Shelf, Vol.4. Principal investigators' reports July-September 1976. Boulder, Colorado, Environmental Research Laboratories, 1976, p.267-275.
Kovacs, A.
31-2630
SEA ICE, REMOTE SENSING, ICE CONDITIONS, RESEARCH PROJECTS.

MP 923
INTERESTING FEATURES OF RADAR IMAGERY OF ICE-COVERED NORTH SLOPE LAKES.
Weeks, W.F., et al, *Journal of glaciology*, 1977, 18(78), p.129-136, In English with French and German summaries. 15 refs.
Sellmann, P.V., Campbell. W.J.
31-3363
LAKE ICE, RADAR PHOTOGRAPHY, ICE WATER INTERFACE, ICE SOLID INTERFACE, ICE COVER THICKNESS, REFLECTIVITY, UNITED STATES—ALASKA—NORTH SLOPE.

Side-looking airborne radar (SLAR) imagery obtained in April-May 1974 from the North Slope of Alaska between Barrow and Harrison Bay indicates that tundra lakes can be separated into two classes based on the strength of the radar returns. Correlations between the areal patterns of the returns, limited ground observations on lake depths and water compositions, and information obtained from LANDSAT imagery strongly suggest that areas of fresh-water lakes giving weak returns are frozen completely to the bottom while areas giving strong returns are not. This is a reasonable interpretation inasmuch as the reflection coefficient associated with the high-dielectric-contrast ice-water interface would be roughly twelve times that associated with the low-contrast ice-soil interface. Brackish lakes also give weak returns even when they are not completely frozen. This is the result of the brine present in the lower portion of the ice cover limiting the penetration of the X-band radiation into the ice. The ability to separate tundra lakes rapidly and easily into these two classes via SLAR should be useful in understanding a wide variety of problems.

MP 924
DYNAMICS OF NEAR-SHORE ICE.
Kovacs, A., et al, Environmental assessment of the Alaskan Continental Shelf, Vol.4. Principal investigators' reports October-December 1976. Boulder, Colorado, Environmental Research Laboratories, 1977, p.106-112.
Weeks, W.F.
31-2776
SEA ICE, FAST ICE, ICE MECHANICS, RADAR ECHOES, LOGISTICS.

MP 925
PRELIMINARY EVALUATION OF NEW LF RADIOWAVE AND MAGNETIC INDUCTION RESISTIVITY UNITS OVER PERMAFROST TERRAIN.
Sellmann, P.V., et al, *National Research Council, Canada. Associate Committee on Geotechnical Research. Technical memorandum,* June 1977, No.119, Symposium on Permafrost Geophysics, Vancouver, Oct. 12, 1976. Proceedings. p.39-42.
Arcone, S.A., Delaney, A.J.
32-2614
MEASURING INSTRUMENTS, ELECTRICAL RESISTIVITY, ELECTROMAGNETIC PROSPECTING, PERMAFROST DISTRIBUTION.

MP 926
SNOW AND SNOW COVER IN MILITARY SCIENCE.
Swinzow, G.K., Fuse/Ammunition/Environment Symposium, Picatinny Arsenal, Dover, N.J., 1978, p.1-239-1-262, 26 refs.
32-2679
SNOW COVER EFFECT, MILITARY OPERATION, MILITARY EQUIPMENT.

Pertinent properties of a snow cover are thicknesses of individual layers, snow density, hardness, grain sizes and temperatures. A snow cover is subject to constant metamorphism and its occurrence is subject to seasonal and geographic distribution. A snow cover is a serious obstacle for traffic, especially military transportation. As a material, snow may be used for shelters, camouflage and fortification. Observations of attenuation of fast projectiles and fragments are reported. It is concluded that snow may be a material seriously affecting fuze mechanisms of certain projectiles and may degrade ammunition effects. Cited and recommended literature covers most of the aspects of the role of snow in warfare.

MP 927
DELINEATION AND ENGINEERING CHARACTERISTICS OF PERMAFROST BENEATH THE BEAUFORT SEA.
Sellmann, P.V., et al, Environmental assessment of the Alaskan Continental Shelf, Vol.4. Principal investigators' reports October-December 1976, Boulder, Colorado, Environmental Research Laboratories, 1977, p.234-237, 1 ref.
Berg, R.L., Brown, J., Blouin, S.E., Chamberlain, E.J., Iskandar, A., Ueda, H.T.
31-2780
SEA ICE, SUBSEA PERMAFROST.

MP 928
UTILITY DISTRIBUTION PRACTICES IN NORTHERN EUROPE.
McFadden, T., et al, *Canada. Environmental Protection Service. Economic and technical review reports,* Jan. 1977, EPS 3-WP-77-1, Symposium on Utilities Delivery in Arctic Regions, March 16-18, 1976, Edmonton, Alberta, Canada. p.70-95.
Aamot, H.W.C.
31-3076
UTILITIES, PIPELINES, PLASTICS, POWER LINE ICING, FROST PROTECTION.

This report represents information on utility distribution systems gathered on a study trip to Scandinavia and Great Britian and Iceland. The information concerns new technology and materials in cold weather related problems and solutions. The distribution systems involved are: water and sewage lines, vacuum sewage and pneumatic solid waste collection lines, heat distribution lines and electrical transmission lines. In Sweden much information was obtained on plastic pipes for water and sewage lines and frost penetration protection. There are large district heating systems in operation and much information was found on heat distribution pipe systems and long distance heat transmission. In Norway, where almost all electricity is produced by hydroelectric stations, information was collected on electric transmission line icing problems and self supporting aerial cables for electrical distribution. A wealth of information was gathered in London where the water and sewage systems are among the oldest and largest in the world and where some material and methods have a long history of success and other new ones are being introduced. District heating technology is also highly developed in London, but large systems have not yet evolved. Pneumatic solid wastes collection systems are being introduced.

MP 929
FREEZE DAMAGE PREVENTION IN UTILITY DISTRIBUTION LINES.
McFadden, T., *Canada. Environmental Protection Service. Economic and technical review reports,* Jan. 1977, EPS 3-WP-77-1, Symposium on Utilities Delivery in Arctic Regions, March 16-18, 1976, Edmonton, Alberta, Canada, p.221-231, 3 refs.
31-3082
WATER PIPES, PIPELINE FREEZING, ICE PRESSURE, PRESSURE CONTROL.

MP 930
FIELD PERFORMANCE OF A SUBARCTIC UTILIDOR.
Reed, S.C., *Canada. Environmental Protection Service. Economic and technical review reports,* Jan. 1977, EPS 3-WP-77-1, Symposium on Utilities Delivery in Arctic Regions, March 16-18, 1976, Edmonton, Alberta, Canada. p.448-468.
31-3092
UTILITIES, COLD WEATHER PERFORMANCE, FOUNDATIONS, WATER SUPPLY, WASTE DISPOSAL.

This paper describes the design, construction, performance and ultimate failure of a functioning utilidor. It is hoped that the lessons learned in this case study description will be of interest and use to engineers concerned with planning and design of such systems.

MP 931
EXAMINING ANTARCTIC SOILS WITH A SCANNING ELECTRON MICROSCOPE.
Kumai, M., et al, *Antarctic journal of the United States,* Dec. 1976, 11(4), p.249-252, 5 refs.
Anderson, D.M., Ugolini, F.C.
31-2963
SOIL CHEMISTRY, WEATHERING, MINERALOGY, X RAY ANALYSIS, ELECTRON MICROSCOPY, ANTARCTICA—BEACON VALLEY, ANTARCTICA—WRIGHT VALLEY.

Results are reported of an investigation by scanning electron microscopy (SEM) and energy dispersion X-ray analysis (EDXA) of the morphology, degree of weathering, and chemical species of six samples of souls from Beacon Valley, lateral valley adjoining Beacon Valley, and lower Wright Valley. EDXA revealed 11 elements in the soil samples: sodium, magnesium, aluminum, silicon, sulfur, chlorine, potassium, calcium, titanium, manganese, and iron. Chromium, palladium, and gold, used in shadowing, were also found. A typical SEM of soil from Beacon Valley showed rounded grains, which had been subjected to much mechanical and chemical weathering. Chemical species identified by EDXA included Ca, Mg, and Na chlorides, and CaSO4. The soil of Beacon Valley is ahumic, saline soil. EDXA of the sandy soil of first lateral valley revealed a quartz particle showing weathering, with contamination by Na, Ca, and Fe, and CaSO4. The ahumic, saline soil of lower Wright Valley shows grains with sharp edges, indicating weak weathering and thus a relatively young age. Magnetite and silicate were found, and Fe, CaC12, and KC1 were identified using EDXA.

MP 932
GEOPHYSICAL METHODS FOR HYDROLOGICAL INVESTIGATIONS IN PERMAFROST REGIONS.
Hoekstra, P., Conference on Soil-Water Problems in Cold Regions, 2nd, Edmonton, Sep. 1976, Proceedings, 1976, p.75-90, 6 refs.
31-1908
GEOPHYSICAL SURVEYS, PERMAFROST HYDROLOGY, ELECTROMAGNETIC PROSPECTING, PERMAFROST INDICATORS, DISCONTINUOUS PERMAFROST.

MP 933
EFFECT OF SNOW COVER ON OBSTACLE PERFORMANCE OF VEHICLES.
Hanamoto, B., *Journal of terramechanics,* Oct. 1976, 13(3), p.121-140, 11 refs. For another version see 27-2795.
31-3028
TRACKED VEHICLES, SNOW COVER EFFECT, COLD WEATHER PERFORMANCE, TOPOGRAPHIC FEATURES, TRAFFICABILITY, SNOW VEHICLES.

Trafficability of terrain is a function of soft soil, hard or rough ground, geometric obstacles, vegetation, and the riverine environment. All of these terrain aspects are altered by cold temperatures and snow cover. This paper examines the effect of snow cover on obstacle crossing performance of vehicles. The mathematical expressions describing step negotiation, trench crossing, and slope climbing on snow covered obstacles are given in terms of tracked vehicle, obstacle, and snow parameters. Tests of two tracked vehicles on snow covered slopes, stream crossings, steps and trenches were conducted, and some of the results were compared with computed values. Differences between computed and experimental values are attributed to neglecting slip-sinkage and track deflection in the computations. (Auth.)

MP 934
REMOTE SENSING OF ACCUMULATED FRAZIL AND BRASH ICE.
Dean, A.M., Jr., National Hydrotechnical Conference, 3rd (with the participation of the Municipal Section), Quebec, May 30-31, 1977. Proceedings, Université Laval, Canadian Society for Civil Engineering, 1977, p.693-704, In English with French summary. 6 refs.
31-3434
FRAZIL ICE, ICE CONDITIONS, REMOTE SENSING, ICE COVER THICKNESS, IMPACT STRENGTH, AERIAL RECONNAISSANCE, COMPUTER APPLICATIONS, ICE NAVIGATION.

The use of a broad-banded impulse radar system for aerial detection of accumulated frazil and brash ice in a 9.5 km reach of the St. Lawrence River is described. The impact of excessive frazil ice accumulation on the extended navigation season and on power generation is discussed. Equipment and technique are evaluated, while the data are presented as a contour map of ice thickness.

MP 935
AIR PHOTO INTERPRETATION OF A SMALL ICE JAM.
DenHartog, S.L., National Hydrotechnical Conference, 3rd (with the participation of the Municipal Section), Quebec, May 30-31, 1977. Proceedings, Université Laval, Canadian Society for Civil Engineering, 1977, p.705-719, *In English with French summary.*
31-3435
ICE JAMS, ICE MECHANICS, PHOTOINTERPRETATION, VELOCITY, SLOPES, AERIAL PHOTOGRAPHS.

Air photos of a small ice jam on the Pemigewasett River near Plymouth, N.H., were taken three days after the jam and compared with photos taken after the ice went out. The winter photos show a marked and sudden decrease in flow size apparently indicative of faster and longer movement of the ice. The spring photos show a number of shallows and obstructions that apparently had no effect on the ice movement. It is concluded that this jam was caused by a change in slope and subsequent reduction in velocity.

MP 936
NUMERICAL SIMULATION OF AIR BUBBLER *SYSTEMS.*
Ashton, G.D., National Hydrotechnical Conference, 3rd (with the participation of the Municipal Section), Quebec, May 30-31, 1977. Proceedings, Université Laval, Canadian Society for Civil Engineering, 1977, p.765-778, In English with French summary. 7 refs.
31-3438
BUBBLING, ICE PREVENTION, ICE CONTROL, HEAT TRANSFER, MECHANICAL ICE PREVENTION, EQUIPMENT, ANALYSIS (MATHEMATICS).

The use of air bubbler systems to suppress ice formation is a technique which has been applied in a variety of situations and with varying degrees of success. Recently two-dimensional line source bubbler systems were analyzed (Ashton, 1974) in an effort to make available a tool which may be used in the design of a bubbler installation. That analysis was a steady-state evaluation of the melting rate of an ice cover above a bubbler system predicted on the basis of the input variables (depth, air discharge rate, water temperature). In actual operation, however, a bubble "sees" changing conditions such as diurnal and longer-term weather conditions, varying water temperatures, and depletion of the available thermal reserve. The simulation presented herin uses the steady-state analysis developed earlier (Ashton, 1974) and steps it in time with each new condition determined from the results of the previous time step. In this sense the analysis herein may be considered quasi-steady. Results of the simulation are presented for an example case for a winter in Duluth, Minnesota and illustrate selection of time step size, effect of various strategies of intermittent operation, and variation in width of open water area with changing weather conditions.

MP 937
REVIEW OF ICE PHYSICS BY P.V. HOBBS.
Ackley, S.F., *American Geophysical Union. Transactions,* June 1977, 58(6), p.341-342.
31-3517
ICE PHYSICS.

MP 938
LONG DISTANCE HEAT TRANSMISSION WITH STEAM AND HOT WATER.
Aamot, H.W.C., et al, International Total Energy Congress, Copenhagen, Oct. 4-8, 1976. Proceedings, 1976, 39p., 9 refs.
Phetteplace, G.
32-2680
HEAT TRANSMISSION, STEAM, WATER PIPELINES, COST ANALYSIS, COMPUTER PROGRAMS.

MP 939
ICE ENGINEERING FACILITY HEATED WITH A CENTRAL HEAT PUMP SYSTEM.
Aamot, H.W.C., et al, Energy Environment Conference, Kansas City, Mar. 27-31, 1977. Proceedings. Kansas City, Missouri, 1977, 4p.
Sector, P.W.
32-2681
BUILDINGS, HEATING, HEAT RECOVERY, REFRIGERATION.

MP 940
SEA ICE THICKNESS PROFILING AND UNDER-ICE OIL ENTRAPMENT
Kovacs, A., Offshore Technology Conference, 9th Houston, May 2-5, 1977. Proceedings, Vol.3, Houston, Texas, 1977, p.547-550, 3 refs.
32-2682
SEA ICE, ICE COVER THICKNESS, MEASURING INSTRUMENTS, RADAR ECHOES.

Results obtained with a unique dual-antenna impulse radar system used to profile first- and multi-year sea ice near Prudhoe Bay, Alaska, are discussed. A description of the radar system is given along with representative field data. From the radar impulse travel times obtained with the use of dual antennas, calculations of thickness, electromagnetic impulse velocity and effective dielectric constant of the ice were made. Ice thicknesses determined by direct measurement and those calculated using the radar impulse travel times were found to be in good agreement. Continuous ice thickness profiles obtained with the radar were analyzed to provide representative cross sections of first-year and multi-year sea ice. These cross sections reveal the undulating bottom surface relief of both ice types. Calculations are presented that indicate a significant amount of oil could be trapped within this bottom relief should the oil be released under the ice from a sea-floor oil-production system.

MP 941
IONIC MIGRATION AND WEATHERING IN FROZEN ANTARCTIC SOILS.
Ugolini, F.C., et al, *Soil science,* June 1973, 115(6), p.461-470, 34 refs.
Anderson, D.M.
28-617
FROZEN GROUND CHEMISTRY, SOIL WATER, SOIL CHEMISTRY, UNFROZEN WATER CONTENT, ION DIFFUSION.

Soils of continental Antarctica are forming in one of the most severe terrestrial environments. Continuously low temperatures and the scarcity of water in the liquid state result in the development of desert-type soils. In an earlier experiment to determine the degree to which radioactive NaCl36 would migrate from a shallow point source in permafrost, movement was observed. To confirm this result, a similar experiment involving Na22Cl has been conducted. Significantly less movement of the Na22 ion was observed. Ionic movement in the unfrozen interfacial films at mineral surfaces in frozen ground is held to be important in chemical weathering in Antarctic and other desert soils.

MP 942
MANAGEMENT OF POWER PLANT WASTE HEAT IN COLD REGIONS.
Aamot, H.W.C., *U.S. Army research and development,* Sep.-Oct. 1975, 16(5), p.22-24, For a detailed treatment of this topic see 29-2708 (CRREL TR 257).
32-2683
BUILDINGS, HEATING, HEAT RECOVERY, COST ANALYSIS.

MP 943
WORD MODEL OF THE BARROW ECOSYSTEM.
Brown, J., et al, Conference on Productivity and Conservation in Northern Circumpolar Lands, Edmonton, *Alberta, Oct.15-17,* 1969. *Proceedings.* Edited by W.A. Fuller and P.G. Kevan. Morges, Switzerland, International Union for Conservation of Nature and National Resources, 1970, p.41-43.
Pitelka, F.A., Coulombe, H.N.
31-4099
ECOSYSTEMS, TUNDRA VEGETATION, TUNDRA SOILS, GRAZING, TEMPERATURE EFFECTS, MOISTURE FACTORS, ANIMALS, UNITED STATES—ALASKA—BARROW.

MP 944
SYNTHESIS AND MODELING OF THE BARROW, ALASKA, ECOSYSTEM.
Coulombe, H.N., et al, Conference on Productivity and Conservation in Northern Circumpolar Lands, Edmonton, Alberta, Oct.15-17, 1969. Proceedings. Edited by W.A. Fuller and P.G. Kevan, Morges, Switzerland, International Union for Conservation of Nature and National Resources, 1970, p.44-49, 6 refs.
Brown, J.
31-4100
ECOSYSTEMS, TUNDRA VEGETATION, TUNDRA SOILS, MODELS, ANIMALS, COMPUTER APPLICATIONS, UNITED STATES—ALASKA—BARROW.

MP 945
ENVIRONMENTAL SETTING, BARROW, ALASKA.

Brown, J., Conference on Productivity and Conservation in Northern Circumpolar Lands, Edmonton, Alberta, Oct.15-17, 1969. Proceedings. Edited by W.A. Fuller and P.G. Kevan, Morges, Switzerland, International Union for Conservation of Nature and National Resources, 1970, p.50-64, 67 refs.

31-4101

ENVIRONMENTS, ARCTIC LANDSCAPES, TUNDRA VEGETATION, TUNDRA SOILS, THERMAL REGIME, PERMAFROST, GEOMORPHOLOGY, SHORELINE MODIFICATION, UNITED STATES—ALASKA—BARROW.

The Barrow environment can be characterized as follows: (1) Situated at the northern extremity of the Arctic Coastal Plain, it has a climate consisting of long, dry, cold winters and short, moist, cool summers. The latter is moderated by the influence of the Arctic Ocean. (2) Vegetation is meadow-like with an abundance of sedges, grasses, herbs and a few dwarf shrub species. (3) Soils are predominantly wet, with an average seasonal thaw of approximately 40 cm. (4) Perennially frozen ground underlies the entire land surface to depths in excess of 300 meters. (5) The near-surface coastal plain sediments are marine in origin and mid- to late-Pleistocene in age. (6) The tundra landscape is charcterized by active geomorphic processes such as lake erosion, polygonal ground formation and frost stirring of the soil.

MP 946
BIBLIOGRAPHY OF THE BARROW, ALASKA, IBP ECOSYSTEM MODEL.

Brown, J., Conference on Productivity and Conservation in Northern Circumpolar Lands, Edmonton, Alberta, Oct.15-17, 1969. Proceedings. Edited by W.A. Fuller and P.G. Kevan. p.65-71.

31-4102

BIBLIOGRAPHIES, ECOSYSTEMS, BIOMASS, ARCTIC REGIONS, MODELS, UNITED STATES —ALASKA—BARROW.

MP 947
CRREL IS DEVELOPING NEW SNOW LOAD DESIGN CRITERIA FOR THE UNITED STATES.

Tobiasson, W., et al, *Eastern Snow Conference. Proceedings,* Feb. 1976, 33rd, p.70-72, Extended abstract only. 10 refs.

Redfield, R.

31-4210

SNOW LOADS, ROOFS, DESIGN CRITERIA.

MP 948
EFFECTS OF RADIATION PENETRATION ON SNOWMELT RUNOFF HYDROGRAPHS.

Colbeck, S.C., *Eastern Snow Conference. Proceedings,* Feb. 1976, 33rd, p.73-82, 10 refs. For this paper in another form see 31-4171.

31-4211

SNOWMELT, RUNOFF, SOLAR RADIATION, WATER FLOW.

Water flow through the unsaturated portion of a snowpack is calculated using various assumptions about radiation penetration into the snow. The results show that for the purposes of hydrologic forecasting, it is sufficiently accurate to assume that all of the radiation absorption occurs on the surface. The error in the calculation of flow is largest for very shallow snowpacks but this error is reduced by radiation absorption at the base of the snow and by the routing of meltwater through the saturated basal layer.

MP 949
ATMOSPHERIC TRACE METALS AND SULFATE IN THE GREENLAND ICE SHEET.

Herron, M.M., et al, *Geochimica et cosmochimica acta,* July 1977, 41(7), p.915-920, 22 refs.

Langway, C.C., Jr., Weiss, H.V., Cragin, J.H.

31-4306

ICE SHEETS, CHEMICAL ANALYSIS, METALS, GREENLAND.

Chemical analyses of surface snow and dated deep ice core samples from Central Greenland suggest that Zn, Pb and sulfate are presently being deposited there at two to three times the natural rates. No recent increases in Cd or V concentrations were observed. Pre-1900 ice shows no measurable effect of the activities of man and represents a good natural aerosol baseline. High enrichment factors relative to average crustal material were observed for Zn, Pb, Cd and sulfate in all samples indicating a natural source other than continental dust is responsible. A high temperature process or vapor phase origin for these enriched elements, possibly volcanism, seems likely.

MP 950
WINTER MAINTENANCE RESEARCH NEEDS.

Minsk, L.D., National Research Council. Transportation Research Board. Highway maintenance research needs; report of a workshop held October 7-10, 1974, Washington, D.C., 1975, p.36-38, FHWA-RD-75-511, PB-247 125.

32-240

WINTER MAINTENANCE, ROAD MAINTENANCE, ICE REMOVAL, ANTIFREEZES, ICE CONTROL, SOIL POLLUTION.

MP 951
COMPRESSIVE AND SHEAR STRENGTHS OF FRAGMENTED ICE COVERS—A LABORATORY STUDY.

Cheng, S.T., et al, *Iowa. University. Iowa Institute of Hydraulic Research. IIHR report,* Aug. 1977, No.206, 82p., ADA-045 246, 7 refs.

Tatinclaux, J.C.

32-1809

FLOATING ICE, COMPRESSIVE STRENGTH, SHEAR STRENGTH, AIR TEMPERATURE, WATER TEMPERATURE, ICE STRUCTURE.

MP 952
PROCEEDINGS OF THE SECOND INTERNATIONAL SYMPOSIUM ON COLD REGIONS ENGINEERING.

Burdick, J., ed, Fairbanks, University of Alaska, Cold Regions Engineers Professional Association, 1977, 597p., For individual papers see 32-283 through 32-320.

Johnson, P., ed.

32-282

MEETINGS, ENGINEERING, LOW TEMPERATURE RESEARCH.

MP 953
FREEZE DAMAGE PROTECTION FOR UTILITY LINES.

McFadden, T., International Symposium on Cold Regions Engineering, 2nd, Fairbanks, Aug. 12-14, 1976, Proceedings, Fairbanks, University of Alaska, Cold Regions Engineers Professional Association, 1977, p.12-16, 2 refs.

32-284

WATER PIPES, PIPELINE FREEZING, PIPELINE INSULATION, ICE PRESSURE.

A method for positioning freeze damage and resultant pipe failures was developed using insulation to position the pressure buildup and subsequent damage area. A pressure relief device fabricated largely from common pipe components was designed and tested. Results show that a significant portion of the failures can be eliminated. Experiments into the mechanism involved in pipe freezing has shown that some of the old concepts are incorrect and new insight into the actual freezing process has resulted.

MP 954
USE OF A LIGHT-COLORED SURFACE TO REDUCE SEASONAL THAW PENETRATION BENEATH EMBANKMENTS ON PERMAFROST.

Berg, R.L., et al, International Symposium on Cold Regions Engineering, 2nd, Fairbanks, Aug. 12-14, 1976, Proceedings, Fairbanks, University of Alaska, Cold Regions Engineers Professional Association, 1977, p.86-99, 9 refs.

Quinn, W.F.

32-289

PERMAFROST CONTROL, EMBANKMENTS, THAW DEPTH, SURFACE STRUCTURE, SOLAR RADIATION, ABSORPTIVITY.

The construction of embankments on permafrost, particularly in regions where the mean ground temperature is close to the melting point, usually results in melting of the permafrost which may cause excessive settlement. The depth of melting (thaw penetration) is considerably increased should the surface of the embankment be covered with a bituminous pavement. This increased melting results from greater absorption of solar radiation by the dark surface. A light-colored surface (white traffic paint) has been used on the asphalt runway at Thule AB, Greenland (a cold permafrost site) and on highway test sections near Fairbanks, Alaska (a warm permafrost site). The selection of light-colored surfacing materials for embankments on permafrost can have a considerable benign influence on the depth of thaw penetration and ultimately thaw consolidation.

MP 955
PERMAFROST EXCAVATING ATTACHMENT FOR HEAVY BULLDOZERS.

Garfield, D.E., et al, International Symposium on Cold Regions Engineering, 2nd, Fairbanks, Aug. 12-14, 1976, Proceedings, Fairbanks, University of Alaska, Cold Regions Engineers Professional Association, 1977, p.144-151, 5 refs.

Mellor, M.

32-292

EXCAVATION, FROZEN GRAVEL, FROZEN GROUND STRENGTH.

In anticipation of military needs for grading and excavating frozen ground, an attachment for heavy engineer tractors was developed. The attachment consists of a hydraulically driven horizontal cutter drum that attaches to bulldozer push arms, together with an auxiliary power source that attaches to the rear of the tractor. The machine is intended to break up frozen soil so that it can be handled by conventional earthmoving equipment. Tests in frozen gravel and in rock outcrops demonstrated that the machine and its cutting picks could withstand the most severe cutting conditions that would normally be met. In frozen gravel, cutting rates at a drum operating depth of 1.0 ft (0.3 m) averaged 1.5 ft/min (7.6 mm/s) at a 30-rev/min drum speed and 1.7 ft/min (8.6 mm/s) at 15 rev/min. Operating at the same depth in frozen silt, cutting rates averaged 1.8 ft/min (9.1 mm/s) at both 30-rev/min and 15-rev/min drum speeds; however, cutting rates varied considerably at the lower drum speed. Modifications suggested for future designs include changes in the tooth lacing pattern and changes in the method of attaching the drum to the tractor.

MP 956
ICE FOG SUPPRESSION USING MONOMOLECULAR FILMS.

McFadden, T., International Symposium on Cold Regions Engineering, 2nd, Fairbanks, Aug. 12-14, 1976, Proceedings, Fairbanks, University of Alaska, Cold Regions Engineers Professional Association, 1977, p.361-367, 6 refs.

32-306

ICE FOG, COUNTERMEASURES, FILMS, CHEMICAL REACTIONS.

Experiments in ice fog suppression using the evaporation reduction abilities of several chemical films are discussed. Advantages and disadvantages of different films are considered and techniques for minimizing some of the disadvantages are described. Fog reduction, both ice fog and cold vapor fog, can be achieved very economically using these films. Up to 85% of the fog normally generated can be suppressed; however, the remaining 15% cannot be eliminated by this technique.

MP 957
MEASURING UNMETERED STEAM USE WITH A CONDENSATE PUMP CYCLE COUNTER.

Johnson, P.R., International Symposium on Cold Regions Engineering, 2nd, Fairbanks, Aug. 12-14, 1976, Proceedings, Fairbanks, University of Alaska, Cold Regions Engineers Professional Association, 1977, p.434-442, 2 refs.

32-313

BUILDINGS, HEAT LOSS, STEAM, PUMPS, MEASUREMENT.

The steam heat used in a combination dormitory and office building at Eielson AFB, Alaska, was measured over a 303-day period using a counter on the condensate return pump. The general relationships between pump cycle frequency and condensate flow were derived. This information was used to calibrate the system and express condensate flow and heat use with the number of pump cycles per hour. The heat used by the building consisted of a constant load for water heating and heat loss within the building and a variable load for space heating. The variable space-heating load was strongly controlled by the outside air temperature and apparently consists of two temperature-dependent heat loss mechanisms. The first is conduction through the walls. It is speculated that the second is open-window air exchange for ventilation and to control room temperatures. The condensate pump cycle counter proved to be an inexpensive means of measuring steam use suitable for engineering and energy conservation studies. Further studies of actual heat consumption by various types of buildings in Alaska are recommended.

MP 958
REINSULATING OLD WOOD FRAME BUILDINGS WITH UREA-FORMALDEHYDE FOAM.

Tobiasson, W., et al, International Symposium on Cold Regions Engineering, 2nd, Fairbanks, Aug. 12-14, 1976, Proceedings, Fairbanks, University of Alaska, Cold Regions Engineers Professional Association, 1977, p.478-487, 6 refs.

Flanders, S.N.

32-314

BUILDINGS, WALLS, THERMAL INSULATION, HEAT LOSS, CELLULAR PLASTICS.

Urea-formaldehyde (UF) foam was investigated for use as an insulation retrofit material in very cold regions. A test installation of the material was made in stud frame walls at Fort Greely, Alaska in August 1975. Two months later, a nondestructive survey of these walls employing thermopiles, thermocouples and an infrared camera revealed a marked improvement in the wall's insulating performance. Cuts in test areas eight months later revealed excellent filling and showed shrinkage to be under 2%. The implications of these and other findings for the suitability of foam as an insulation retrofit material are discussed. We are cautiously optimistic that UF foam has good potential for use in very cold regions.

MP 959
SOME ECONOMIC BENEFITS OF ICE BOOMS.
Perham, R.E., International Symposium on Cold Regions Engineering, 2nd, Fairbanks, Aug. 12-14, 1976, Proceedings, Fairbanks, University of Alaska, Cold Regions Engineers Professional Association, 1977, p.570-591, 29 refs.
32-319
ICE BOOMS, ICE CONTROL, RIVER ICE, LOADS (FORCES), COST ANALYSIS, ECONOMICS.

In early winter, ice booms are used to assist nature in quickly forming a solid ice cover on rivers. The open water, insulated in this way, is no longer the source of frazil ice which, in the past, has caused ice jams, flooding, and the loss of electrical generating capacity. They function in other ways as well such as strengthening the ice sheet edge against subsequent damage and restraining its movement. Ice booms are basically lines of floating timbers or pontoons held in place by heavy cable structures connected to buried anchors. They were developed and are used mainly by hydroelectric power groups but they also help facilitate ship navigation in winter. The cost of these ice control devices over the past 17 years has ranged from about \$48/ft (\$156/m) to \$333/ft (\$1094/m) with one set costing approximately \$1,500,000. The value of many ice booms can best be related to the cost of replacing the electric power that could be lost if they were not present, as opposed to trying to choose a cost basis for a flood. A rough estimate of \$0.01/kWh for the value of replacement power is used here. The most valuable ice boom could be the Lake Erie Ice boom which saves an estimated \$13,000,000 per year. Next are the ice booms on the Beauharnois Canal which are used with particular operating techniques to save approximately \$4,300,000 per year. Ice booms can also help save millions in shipping costs as well by stopping excessive ice movements during the navigation season in winter on the Great Lakes.

MP 960
YUKON RIVER BREAKUP 1976.
Johnson, P., et al, International Symposium on Cold Regions Engineering, 2nd, Fairbanks, Aug. 12-14, 1976, Proceedings, Fairbanks, University of Alaska, Cold Regions Engineers Professional Association, 1977, p.592-596, 8 refs.
Burdick, J., Esch, D., McFadden, T., Osterkamp, T.E., Zarling, J.
32-320
RIVER ICE, ICE BREAKUP, ICE LOADS, OFFSHORE STRUCTURES.

A recently completed bridge across the Yukon River, north of Fairbanks, Alaska, provides an opportunity for studying breakup processes and measuring ice forces on a structure in a major river where ice conditions are near the continental extreme. Above the bridge the river flows through the 200-mile long Yukon Flats, a marshy, lake-dotted area. The multiple channels of the river meander back and forth providing a very large water surface for winter ice production. The winters are long and severely cold with only light snowfall so the Flats produce very large quantities of thick ice which pass through the bridge each spring. The bridge is a six-span continuous orthotropic-deck structure spanning a 2,000-foot channel. Five reinforced concrete piers secured to bedrock with prestressed rock anchors are subject to river ice. Steel legs rise from the tops of the piers to carry the deck. USACRREL, University of Alaska, and Alaska Department of Highways personnel observed ice-bridge interactions during the 1976 breakup. Time lapse and regular speed Super 8 movie and 35mm still photographs were taken. Several types of ice failure were observed including crushing along the full width of the piers, splitting, combined splitting and crushing and non-failure.

MP 961
INFRARED DETECTIVE: THERMOGRAMS AND ROOF MOISTURE.
Korhonen, C., et al, *ASHRAE journal,* Sep. 1977, 19(9), p.41-44.
Tobiasson, W., Dudley, T.
32-508
INFRARED EQUIPMENT, ROOFS, MOISTURE, INSULATION.

Four building roofs at Pease AFB were surveyed with a hand-held infrared camera to detect wet insulation. Areas of wet insulation on these roofs were marked with spray paint, and 3-in.-dia core samples of the built-up membrane and insulation were taken to verify wet and dry conditions. Flashing defects are considered responsible for most of the wet insulation uncovered in this survey. Recommendations for maintenance, repair, and replacement were developed from the infrared surveys, core samples and visual examinations.

MP 962
REPETITIVE LOADING TESTS ON MEMBRANE ENVELOPED ROAD SECTIONS DURING *FREEZE THAW.*
Smith, N., et al, Preprints of papers presented at a specialty session of the ASCE Fall Convention and Exhibit, San Francisco, California, Oct. 17-21, 1977, American Society of Civil Engineers, 1977, p.171-197, 15 refs.
Eaton, R.A., Stubstad, J.
32-562
FREEZE THAW TESTS, ROADS, SUBGRADE PREPARATION, PROTECTIVE COATINGS, SOIL AGGREGATES, SOIL STRENGTH, DYNAMIC LOADS.

MP 963
DYNAMIC IN-SITU PROPERTIES TEST IN FINE-GRAINED PERMAFROST.
Blouin, S.E., Preprints of papers presented at a specialty session of the ASCE Fall Convention and Exhibit, San Francisco, California, Oct. 17-21, 1977, American Society of Civil Engineers, 1977, p.282-313, 19 refs.
32-565
PERMAFROST PHYSICS, EXPLOSION EFFECTS, BLASTING.

MP 964
CASE FOR COMPARISON AND STANDARDIZATION OF CARBON DIOXIDE REFERENCE GASES.
Kelley, J.J., et al, Interbiome Workshop on Gaseous Exchange Methodology, Terrestrial Primary Productivity, Oak Ridge National Laboratory, 1973. Proceedings, 1973, p.163-181, 18 refs.
Coyne, P.I.
32-675
CARBON DIOXIDE, ENVIRONMENTS, PHOTOSYNTHESIS, MEASURING INSTRUMENTS, TUNDRA BIOME, SPECTROMETERS.

Infrared gas analytical techniques have made it possible to detect small amounts and changes in carbon dioxide in the environment. The reliability and intercomparison of these measurements depends on the ability to calibrate the IRGA with a high degree of precision and accuracy. A mutual comparison scheme is presented to provide a method for calibrating an infrared gas analyzer and to document changes that occur in CO2 reference gas standards. It is suggested that a need exists to establish a central reference gas laboratory for the purpose of supply investigators with accurate reference gas standards. (Auth.)

MP 965
WASTEWATER TREATMENT IN COLD REGIONS.
Sletten, R.S., et al, *U.S. Army Cold Regions Research and Engineering Laboratory,* 1976, 15p., ADA-026 156, Unpublished report.
Uiga, A.
32-1274
WASTE TREATMENT, WATER TREATMENT, MILITARY FACILITIES.

Wastewater treatment at remote military installations in Alaska presently consists of aerated lagoons and extended aeration package plants. Although performance data for these systems are either very limited or in most cases nonexistent, indications are that most of these systems can not meet secondary effluent criteria as defined by the EPA. Processes for upgrading to meet the new criteria must be as simple as possible to design, build and operate. In particular, the requirements for operation and maintenance should be minimal due to the remote, isolated nature of most of the camps. Processes which appear to be feasible include land application, intermittent filtration, and variations of ponding.

MP 966
PASSAGE OF ICE AT HYDRAULIC STRUCTURES.
Calkins, D.J., et al, Annual Symposium of the Waterways, Harbors and Coastal Engineering Division of ASCE, 3rd, Fort Collins, Colorado, Aug. 10-12, 1976. [Proceedings], New York, American Society of Civil Engineers, 1976, p.1726-1736, 32 refs.
Ashton, G.D.
32-836
HYDRAULIC STRUCTURES, ICE LOADS, ICE MECHANICS, ICE BOOMS, ICE STRENGTH, RIVER ICE, ICE CONTROL.

The passage of ice through hydraulic structures is an important consideration in the construction of such works in the northern areas. The performance of various structures in passing ice has been documented mainly in descriptive terms; however, some physical measurements have been made on the volumetric ice discharge through such openings. By expressing the ice discharge as a surface concentration, meaningful site comparisons can be made. Physical model studies on various aspects of ice related problems in rivers and at their structures have been increasing within the last five years. One major problem area is the assessment and influence of the strength of ice, which applies to both the field and laboratory studies.

MP 967
EFFECT OF SEDIMENT ORGANIC MATTER ON MIGRATION OF VARIOUS CHEMICAL *CONSTITUENTS* DURING DISPOSAL OF DREDGED MATERIAL.
Blom, B.E., et al, *U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi. Contractor report,* May 1976, WES-CR-D-76-7, 183p., ADA-027 394.
Jenkins, T.F., Leggett, D.C., Murrmann, R.P.
32-850
SEDIMENT TRANSPORT, WASTE DISPOSAL, WATER POLLUTION, WATER CHEMISTRY, DREDGING.

MP 968
WASTEWATER TREATMENT ALTERNATIVE NEEDED.
Iskandar, I.K., et al, *Water and wastes engineering,* Nov. 1977, 14(11), p.82-87, Refs.
Sletten, R.S., Jenkins, T.F., Leggett, D.C.
32-974
WASTE TREATMENT, WATER TREATMENT, SEEPAGE, SEWAGE TREATMENT.

MP 969
ICE DECAY PATTERNS ON A LAKE, A RIVER AND COASTAL BAY IN CANADA.
Bilello, M.A., Canadian Association of Geographers. Programme and abstracts [of the CAG Conference, 1977], University of Regina, 1977, p.120-127, 4 refs.
32-929
ICE COVER THICKNESS, ICE BREAKUP, ICE DETERIORATION, LAKE ICE, RIVER ICE, SEA ICE.

MP 970
RATE—THE INFLUENCE OF GRAZING ON THE ARCTIC TUNDRA ECOSYSTEMS.
Batzli, G.O., et al, *Arctic bulletin,* 1976, 2(9), p.153-160.
Brown, J.
31-394
RESEARCH PROJECTS, TUNDRA VEGETATION, ECOSYSTEMS, ANIMALS, GRAZING, PLANTS (BOTANY), TUNDRA SOILS.

MP 971
COMPUTER MODELING OF TERRAIN MODIFICATIONS IN THE ARCTIC AND SUBARCTIC.
Outcalt, S.I., et al, Symposium: Geography of polar countries. XXIII International Geographical Congress, Leningrad, USSR, 22-26 July 1976, edited by J. Brown. Selected papers and summaries. CRREL SR 77-6, Hanover, New Hampshire, U.S. Army Cold Regions Research and Engineering Laboratory, 1977, p.24-32, ADA-038 379, In English with Russian summary. 41 refs.
Brown, J.
32-1305
TERRAIN IDENTIFICATION, COMPUTERIZED SIMULATION, MODELS, VEGETATION, PERMAFROST STRUCTURE, HUMAN FACTORS.

MP 972
LOCK WALL DEICING.
Hanamoto, B., Lock wall deicing studies, edited by B. Hanamoto. CRREL SR 77-22, Hanover, New Hampshire, Cold Regions Research and Engineering Laboratory, 1977, p.7-14, ADA-044 943.
32-1350
ICE REMOVAL, ICE PREVENTION, INFLATABLE STRUCTURES, PROTECTIVE COATINGS, LOCKS (WATERWAYS).

MP 973
LOCK WALL DEICING WITH HIGH VELOCITY WATER JET AT SOO LOCKS, MI.
Calkins, D.J., et al, Lock wall deicing studies, edited by B. Hanamoto. CRREL SR 77-22, Hanover, New Hampshire, Cold Regions Research and Engineering Laboratory, 1977, p.23-35, ADA-044 943, 2 refs.
Mellor, M., Ueda, H.T.
32-1351
ICE REMOVAL, WATER EROSION, HIGH PRESSURE TESTS, LOCKS (WATERWAYS).

MP 974

LABORATORY EXPERIMENTS ON LOCK WALL DEICING USING PNEUMATIC DEVICES.

Itagaki, K., et al, Lock wall deicing studies, edited by *B. Hanamoto.* CRREL SR 77-22, Hanover, New Hampshire, Cold Regions Research and Engineering Laboratory, 1977, p.53-68, ADA-044 943, 1 ref.

Frank, M., Ackley, S.F.

32-1352

ICE REMOVAL, INFLATABLE STRUCTURES, LABORATORY TECHNIQUES, LOCKS (WATERWAYS).

MP 975

LAND APPLICATION OF WASTEWATER: FORAGE GROWTH AND UTILIZATION OF APPLIED NITROGEN, PHOSPHORUS AND POTASSIUM.

Palazzo, A.J., Cornell Agricultural Waste Management Conference, Ithaca, N.Y., 1976. Proceedings. Land as a waste management alternative. Edited by R.C. Loehr, Ann Arbor, Mich., Ann Arbor Science, 1977, p.171-180, 8 refs.

32-1526

WASTE DISPOSAL, SOIL CHEMISTRY, WATER CHEMISTRY, LAND DEVELOPMENT, PLANTS (BOTANY), GRASSES, GROWTH.

Data have been presented on the growth and chemical composition of forages when influenced by various application rates of wastewater during 1974 and 1975. The results show that the greatest average annual forage yields and N and P removal occurred at the highest application rate (15 cm/wk). However, forage removal efficiency of applied N and P was greatest at the lowest application rate of 5 cm/wk. At this rate an average of 97 percent of the applied N *and 35 percent of the applied P was contained in the forage.* Analyses performed in 1974 and 1975 showed a reduction in the levels of K in the soil and forage in 1975, relative to 1974, which indicates a requirement for K fertilization for sustained productivity. The reducton in K was related to the large quantities of this element required by crops and its low concentration in the wastewater. Soil analyses also showed reductions in soil pH and total exchangeable cations to levels which could be corrected by liming.

MP 976

PRELIMINARY EVALUATION OF 88 YEARS RAPID INFILTRATION OF RAW MUNICIPAL SEWAGE AT CALUMET, MICHIGAN.

Baillod, C.R., et al, Cornell Agricultural Waste Management Conference, Ithaca, N.Y., 1976. Proceedings. Land as a waste management alternative. Edited by R.C. Loehr, Ann Arbor, Mich., Ann Arbor Science, 1977, p.489-510, 16 refs.

Waters, R.G., Iskandar, I.K., Uiga, A.

32-1527

WASTE DISPOSAL, WATER TREATMENT, LAND DEVELOPMENT, SEEPAGE, SEWAGE DISPOSAL, WATER CHEMISTRY.

MP 977

URBAN WASTE AS A SOURCE OF HEAVY METALS IN LAND TREATMENT.

Iskandar, I.K., International Conference on Heavy Metals in the Environment, Toronto, Ont., Canada, Oct. 27-31, 1975. Proceedings, Toronto, Canada, [1976], p.417-432, In English with French summary. 36 refs.

32-1528

WASTE DISPOSAL, SOIL CHEMISTRY, MICROELEMENT CONTENT, PLANTS (BOTANY), LAND DEVELOPMENT, SOIL POLLUTION, GRASSES, METALS.

Heavy metal accumulation in soils and forages of a slow infiltration prototype land treatment system over a two year period is discussed. Uptake of heavy metals by plants and soils varied according to the amounts applied, soil type, and mode of wastewater application. Charlton silt loam soil retained more heavy metals than Windsor sandy loam. Heavy metals were confined to the top 15 cm of the soil and vertical movement occurred only in the soil from the treatment receiving the highest application rate (15 cm/wk). Movement of heavy metals in this treatment was thought to be due to a redistribution of organic matter (hydraulic effect), a decrease in soil pH or both. Forages (quack grass) from all the treatments contained much higher concentrations of heavy metals than the control. There were significant differences in plant tissue heavy metal accumulation between the different cuts. This was related to the concentration of heavy metals in the applied effluent. Forages from the second cut contained Cd and Ni and to some extent Cu at "toxic" levels, while Zn, Cr, Hg and Pb were present in normal or slightly higher amounts. Spray irrigation of heavy metal-spiked wastewater resulted in much higher concentrations in the plant tissue than in those from flood irrigation treatments. This could be due to absorption of heavy metals by the leaves in the sprayed forages.

MP 978

FREEZE-THAW ENHANCEMENT OF THE DRAINAGE AND CONSOLIDATION OF FINE-GRAINED DREDGED MATERIAL IN CONFINED DISPOSAL AREAS.

Chamberlain, E.J., *U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi. Technical report,* Oct. 1977, TR-D-77-16, 94p., ADA-046 400.

Blouin, S.E.

32-1515

WASTE DISPOSAL, DREDGING, SOIL COMPACTION, SOIL FREEZING, FREEZE THAW CYCLES, PERMEABILITY.

Fine-grained dredged material obtained from disposal sites in the Great Lakes region was subjected to controlled freeze-thaw cycling in a special laboratory consolidometer. Volume changes and permeabilities were observed after full consolidation and freeze-thaw cycling for applied pressures in the range of 0.93 to 30.73 kPa. It was observed that as much as 20 percent or more volume reduction results when dredged material with liquid limits in the range of 60 to 90 percent is subjected to one cycle of freezing and thawing. The degree of overconsolidation by freezing and thawing appears to decrease with increasing amounts of coarse materials and with increasing plasticity. The vertical permeability of all materials examined was increased as much as two orders of magnitude, the greatest increase in permeability occurring for the fine-grained materials at the lowest stress levels.

MP 979

WASTEWATER REUSE AT LIVERMORE, CALIFORNIA.

Uiga, A., et al, Cornell Agricultural Waste Management Conference, Ithaca, N.Y., 1976. Proceedings. Land as a waste management alternative. Edited by R.C. Loehr, Ann Arbor, Mich., Ann Arbor Science, 1977, p.511-531, 24 refs.

Iskandar, I.K., McKim, H.L.

32-1529

WASTE TREATMENT, WATER TREATMENT, WATER CHEMISTRY.

Wastewater reuse occurs at Livermore, California by application of treated effluent to a golf course, to a farmland, to an airport area and to a stream. Salinity problems occurred on the clay soils of the golf course because requirements for daily site access and wastewater application were contradictory. The effluent was successfully reused at the agriculture site and disposal area. The outfall discharge increased the total dissolved solids of the receiving water and discharged large quantities of chlorine. Soil chemical analysis showed that exchangeable sodium percentage, total phosphorus, soluble phosphorus, pH, and organic carbon were changed but not critically by effluent reuse. The changes, except in pH, could be explained by existing agronomic techniques for irrigation in a semi-arid climate.

MP 980

DETERMINATION OF 2,4,6-TRINITROTOLUENE IN WATER BY CONVERSION TO NITRATE.

Leggett, D.C., *Analytical chemistry,* 1977, Vol.49, p.880, 5 refs.

32-1530

WATER TREATMENT, WATER CHEMISTRY, WASTE DISPOSAL, WASTE TREATMENT.

MP 981

WATER VAPOR ADSORPTION BY SODIUM MONTMORILLONITE AT -5C.

Anderson, D.M., et al, *Icarus,* 1978, Vol.34, p.638-644, 8 refs.

Schwarz, M.J., Tice, A.R.

33-634

WATER VAPOR, ADSORPTION, LOW TEMPERATURE TESTS, CLAY MINERALS, MARS (PLANET).

A large amount of interest has recently been expressed pertaining to the quanitity of physically adsorbed water by the Martian regolith. Thermodynamic calculations based on experimentally determined adsorption and desorption isotherms and extrapolated to subzero temperatures indicate that physical adsorption of more than one or two monomolecular layers is highly unlikely under Martian conditions. Any additional water would find ice to be the state of lowest energy and therefore the most stable form. To test the validity of the thermodynamic calculations, we have measured adsorption and desorption isotherms of sodium montmorillonite at -5C. To a first approximation it was found to be valid.

MP 982

ROOF LOADS RESULTING FROM RAIN ON SNOW; RESULTS OF A PHYSICAL MODEL.

Colbeck, S.C., *Canadian journal of civil engineering,* Dec. 1977, 4(4), p.482-490, In English with French summary. 11 refs. See also 32-1151 (CR 77-12).

32-1648

ROOFS, SNOW LOADS, RAIN, MATHEMATICAL MODELS.

A physical model is used to calculate roof loads due to rain on a snow covered roof. A snow depth of 0.5 m and the twenty-five year rainstorm in Hanover, New Hampshire, are used in the examples. For a flat roof with 10 m parallel flow to gutters, the total liquid weight can increase the roof load by about 50%. The weight of the transient liquid is greatly increased if the mode of flow is radial to central drains and is decreased if the roof is slightly inclined or if significant melt channels form in the basal layer. However, the wetting of the snow over its entire depth will still cause a significant weight of transient liquid. Snow drifting can cause very large, local loads but the effects of snow temperature and antecedent moisture are not too important. Depending on the circumstances, the largest load can occur for either a long duration, low intensity rainstorm or a short duration, high intensity rainstorm. The former occurs if the saturated layer makes a significant contribution to the total live load whereas the latter occurs when the liquid weight is due mainly to the unsaturated layer. Further study is needed to establish the joint probabilities of combined snow and rain loads, especially when rain and snowmelt occur simultaneously.

MP 983

EXAMINATION OF THE VISCOUS WIND-DRIVEN CIRCULATION OF THE ARCTIC ICE COVER OVER A TWO YEAR PERIOD.

Hibler, W.D., III, et al, *Arctic Ice Dynamics Joint Experiment. AIDJEX bulletin,* Sep. 1977, No.37, p.95-133, 27 refs.

Tucker, W.B.

32-1696

SEA ICE, WIND FACTORS, VISCOUS FLOW, MATHEMATICAL MODELS, BOUNDARY VALUE PROBLEMS.

A detailed re-examination of the viscous approach is made by comparing predicted with observed ice drift in the Arctic basin over a two-year period employing a viscous constitutive law having both bulk and shear viscosities. Numerical drift calculations for the Arctic Basin are carried out at 4-day intervals over a two-year period employing periodic boundary conditions. Drift predictions are compared with the observed drift of three contemporaneous drifting stations with reasonable agreement. The largest errors are found to occur in late summer, and may be due to nonsteady current effects. Boundary value calculations show that reduction of the shear viscosity (while still maintaining a large bulk viscosity) reduces the excessive stiffening often found in viscous models while still maintaining substantial changes in drift direction due to boundaries. Sensitivity studies show steady current effects to be small for drift rates over tens of days but not negligible for cumulative drift over years.

MP 984

ANALYSIS OF ENVIRONMENTAL FACTORS AFFECTING ARMY OPERATIONS IN THE ARCTIC BASIN.

Sater, J.E., ed, Montreal, Quebec, Feb. 1962, 11p., For a more extensive report see SIP 21843.

Arctic Institute of North America.

32-1902

ENVIRONMENTS, MILITARY OPERATION, RESEARCH PROJECTS, MILITARY RESEARCH, ARCTIC REGIONS.

MP 985

ARCTIC TRANSPORTATION: OPERATIONAL AND ENVIRONMENTAL EVALUATION OF AN AIR CUSHION VEHICLE IN NORTHERN ALASKA.

Abele, G., et al, *Journal of pressure vessel technology,* Feb. 1977, 99(1), p.176-182, 8 refs.

Brown, J.

32-1801

AIR CUSHION VEHICLES, TRANSPORTATION, TRAFFICABILITY, ARCTIC LANADSCAPES, ENVIRONMENTS, ENVIRONMENTAL IMPACT, TUNDRA VEGETATION, DAMAGE.

MP 986

SEA ICE ENGINEERING.

Assur, A., International Conference on Port and Ocean Engineering Under Arctic Conditions, 3rd, Fairbanks, Aug. 11-15, 1975, Vol.1, University of Alaska, 1976, p.231-234, Extended summary only.

32-2211

SEA ICE, ICE MECHANICS, ENGINEERING.

MP 987

ISLANDS OF GROUNDED SEA ICE.

Dehn, W.F., et al, Environmental assessment of the Alaskan continental shelf; Vol. 14, Ice. Principal Investigators' reports for the year ending March 1976, Boulder, Colorado, Environmental Research Laboratories, 1976, p.35-50, 28 refs. Preprint from 1975 POAC Conference.

Gow, A.J.

31-629

ICE ISLANDS, REMOTE SENSING, SPACEBORNE PHOTOGRAPHY, BATHYMETRY.

Large areas of grounded sea ice have been reported by early arctic explorers and more recently by the U.S. Coast Guard. The ESSA, ERTS, NOAA, and DMSP satellites now provide multi-spectral imagery with sufficiently high resolution to allow detailed sequential observations to be made of the movement and spatial extent of arctic sea ice. This report discusses the location, formation, and decay of five large (>30 sq km) islands of grounded sea ice in the southern Chukchi Sea as observed for an extended period of time using satellite imagery. Measurements of the bathymetry around one grounded sea ice feature are presented along with observations made and photos taken from the ice surface. The potential use of these sea ice islands as research stations is also discussed.

MP 988

IMPACT OF SPHERES ON ICE. CLOSURE.

Yen, Y.-C., et al, *American Society of Civil Engineers. Engineering Mechanics Division. Journal,* April 1972, 98(EM2), p.473, For original article and prior discussion see 25-2241 and 26-0978 respectively.

Odar, F., Bracy, L.R.

26-3743

ICE MECHANICS, IMPACT STRENGTH.

MP 989

PROGRESS REPORT ON 25 CM RADAR OBSERVATIONS OF THE 1971 AIDJEX STUDIES.

Thompson, T.W., et al, *Arctic Ice Dynamics Joint Experiment. AIDJEX bulletin,* Feb. 1972, No.12, p.1-16.

Bishop, R.J., Brown, W.E.

27-507

RADAR PHOTOGRAPHY, ICE FLOES.

MP 990

USE OF INSTRUMENTATION UNDER ARCTIC CONDITIONS.

Atkins, R.T., Arctic Logistics Support Technology. Proceedings of a symposium held at Hershey, Pennsylvania, Nov. 1, 1971, Arctic Institute of North America, 1972, p.183-188, AD-744 669.

27-630

INSTRUMENTS.

MP 991

ARCTIC AND SUBARCTIC ENVIRONMENTAL ANALYSES UTILIZING ERTS-1 IMAGERY; BIMONTHLY PROGRESS REPORT, 23 JUNE - 23 AUG. 1972.

Anderson, D.M., et al, *U.S. National Aeronautics and Space Administration. Contractor report,* Aug. 23, 1972, NASA-CR-128095, 3p., N72-31361.

Haugen, R.K., Gatto, L.W., Slaughter, C.W., Marlar, T.L.

27-1441

REMOTE SENSING, ARCTIC ENVIRONMENT, SPACECRAFT.

MP 992

SURFACE-WAVE DISPERSION IN BYRD LAND, ANTARCTICA.

Acharya, H.K., *Seismological Society of America. Bulletin,* Aug. 1972, 62(4), p.955-959, 12 refs.

27-1490

ICE SHEETS, WAVE PROPAGATION, SNOW ACOUSTICS, SEISMIC VELOCITY, ANTARCTICA—MARIE BYRD LAND.

Assuming constant density and Poisson's ratio of 0.25, theoretical surface-wave dispersion has been computed for the Byrd Land area in Antarctica, where the velocity increases monotonically with depth. Comparison with observed dispersion indicates 8 to 10 per cent anisotropy in the ice cap. Such anisotropy was also detected from ultrasonic velocity measurements on snow cores. (Auth.)

MP 993

SMALL-SCALE STRAIN MEASUREMENTS ON A GLACIER SURFACE.

Colbeck, S.C., et al, *Journal of glaciology,* July 1971, 10(59), p.237-243, Also published as Washington (State) University. Department of Atmospheric Sciences. Technical report TR-12, Nov. 25, 1970. In English with French and German summaries. 10 refs.

Evans, R.J.

27-1704

GLACIER FLOW, CREVASSES, ICE DEFORMATION, STRAIN MEASUREMENT.

Surface deformations in the neighborhood of a crevasse field were measured over short (3 m) gage lengths in order to study flow conditions associated with crevasse formation. The results obtained were unusual in that they were inconsistent with large-scale results found by previous workers. It was concluded that the presence of small-scale surface effects, such as fractures, pot-holes and healed crevasses give rise to small-scale deformation fields with large spatial and temporal variations and that there is a lower limit of gage length below which deformation measurements pertinent to regional flow phenomena cannot be made. This lower limit is apparently an order of magnitude greater than the spacing of the features which give rise to localized effects.

MP 994

MARIE BYRD LAND QUATERNARY VOLCANISM: BYRD ICE CORE CORRELATIONS AND POSSIBLE CLIMATIC INFLUENCES.

LeMasurier, W.E., *Antarctic journal of the United States,* Sept.-Oct. 1972, 7(5), p.139-141, 4 refs.

27-1956

ICE CORES, DRILL CORE ANALYSIS, VOLCANIC ASH, ANTARCTICA—MARIE BYRD LAND.

Published petrographic descriptions of the volcanic ash bands in the Byrd Station deep drill core (Gow, 1971; E-10325, and Gow and Williamson, 1971; F-10462) have suggested some sources for ash among the volcanoes in Byrd Land and some possible climatic implications of this volcanism. The available petrographic and age data on volcanoes that are known to have erupted in Byrd Land in Quaternary time - Mt. Murphy, Toney Mountain, Mt. Takahe, and Mt. Waesche - suggest that Mt. Waesche and Mt. Takahe were the major sources of ash. Events recorded in the core occurred within the last 75,000 yr. The most distinctive petrographic characteristics of the Quaternary volcanic rocks are the abundance of olivine, plagioclase, and titanaugite phenocrysts in the basalts, and of alkali feldspar and aegerine phenocrysts in the acid rocks.

MP 995

SUMMARY OF THE 1971 US TUNDRA BIOME PROGRAM.

Brown, J., International Biological Programme, Tundra biome; Proceedings IV. International Meeting on the Biological Productivity of Tundra, Leningrad USSR, October 1971. Edited by F.E. Wielgolaski and Th. Rosswall. Stockholm, Tundra Biome Steering Committee, April 1972, p.306-313.

27-2697

RESEARCH PROJECTS, TUNDRA BIOME, UNITED STATES—ALASKA.

Briefly outlined are the U.S. Tundra Biome studies including the interrelationships between tundra fauna and flora, photosynthesis, carbon dioxide budget, wet tundra soil science, and lake and pond ecosystems. Activities were centered primarily on the Barrow, Alaska area.

MP 996

INTERPRETATION OF THE TENSILE STRENGTH OF ICE UNDER TRIAXIAL STRESS.

Nevel, D.E., et al, International Conference on Port and Ocean Engineering Under Arctic Conditions, 3rd, *Fairbanks, Aug. 11-15, 1975, Vol.1, University of* Alaska, 1976, p.375-387, 12 refs.

Haynes, F.D.

32-2219

ICE MECHANICS, ICE STRENGTH, TENSILE STRENGTH, STRESSES.

Griffith, and later Babel, have previously developed a tensile fracture criterion for a two-dimensional state of stress. This theory is extended to the compression-compression region. From this theory the angle of fracture is developed. For uniaxial compression, the angle may be anywhere from 0 to 30 degrees measured from the direction of loading, depending upon the shape of the cavity. The theory is extended conceptually to three dimensions. Triaxial test data by Haynes for snow-ice are shown in this three-dimensional fracture theory. The test data are slightly less than that predicted when the void in the snow-ice is spherical.

MP 997

OXYGEN ISOTOPE PROFILES THROUGH THE ANTARCTIC AND GREENLAND ICE SHEETS.

Johnsen, S.J., et al, *Nature,* Feb.25,1972, 235(5339), p.429-434, 37 refs.

Dansgaard, W., Clausen, H.B., Langway, C.C., Jr.

27-3046

ISOTOPE ANALYSIS, ICE SHEETS, OXYGEN ISOTOPES, PALEOCLIMATOLOGY, ICE CORES, GREENLAND, ANTARCTICA—BYRD STATION.

The Camp Century, Greenland, deep ice core reveals seasonal variations in the isotopic composition of the ice back to 8,300 *y.b.p.* This is not the case for the Byrd Station, Antarctica, deep ice core. Both cores show long-term perturbations in isotopic composition reflecting climatic changes from before the beginning of the last glaciation. But the complexity of the glaciology regime at Byrd Station precludes a rational choice of a time scale. Pole-to-pole correlations of the palaeoclimatic data therefore become speculative except for the more pronounced features and general trends.

MP 998

CLIMATIC OSCILLATIONS DEPICTED AND PREDICTED BY ISOTOPE ANALYSES OF A GREENLAND ICE CORE.

Dansgaard, W., et al, *International Conference on Port and Ocean Engineering under Arctic Conditions. Proceedings,* 1971, 1st, Vol.1, p.17-22, 8 refs.

Johnsen, S.J., Clausen, H.B., Langway, C.C., Jr.

28-545

ICE CORES, ISOTOPE ANALYSIS, CLIMATIC CHANGES, GREENLAND.

MP 1000

TECHNIQUE FOR PRODUCING STRAIN-FREE FLAT SURFACES ON SINGLE CRYSTALS OF ICE: COMMENTS ON DR. H. BADER'S LETTER AND DR. K. ITAGAKI'S LETTER.

Tobin, T.M., *Journal of glaciology,* 1973, 12(66), p.519-520, 3 refs.

28-2375

ICE CRYSTALS, CRYSTAL STUDY TECHNIQUES, MICROSCOPY.

MP 1001

CUTTING ICE WITH HIGH PRESSURE WATER JETS.

Mellor, M., et al, U.S. Coast Guard. Report USCG-D-15-73, Hanover, New Hampshire, U.S. Army Cold Regions Research and Engineering Laboratory, 1973, 22p., AD-766 172.

Gagnon, F.

28-2886

ICE CUTTING, ICE BREAKING, HYDRAULIC JETS.

The report describes high pressure water jet ice cutting experiments conducted in support of the Coast Guard domestice icebreaking program. The test objectives were to determine power requirements for cutting two feet of fresh water ice at a speed of advance of 5 knots. The results of the tests show extremely high power requirements even when using state-of-the art equipment pumping at 100,000 psi. (Auth.)

MP 1002

RIVER-ICE PROBLEMS: A STATE-OF-THE-ART SURVEY AND ASSESSMENT OF RESEARCH NEEDS.

Burgi, P.H., et al, *American Society of Civil Engineers. Hydraulics Division. Journal,* Jan. 1974, 100(HY1), p.1-15, 36 refs.

Childers, J.M., Frankenstein, G.E., Kennedy, J.F., Ashton, G.D.

28-2918

RIVER ICE, ICE JAMS, ICE FORMATION, SEASONAL FREEZE THAW, ICE MECHANICS, ICE THERMAL PROPERTIES.

MP 1003

ARCTIC AND SUBARCTIC ENVIRONMENTAL ANALYSES USING ERTS-1 IMAGERY. PROGRESS REPORT DEC. 72-JUNE 73.

Anderson, D.M., et al, *U.S. National Aeronautics and Space Administration. Contractor report,* June 23, 1973, NASA-CR-135858, 75p., E74-10017.

McKim, H.L., Haugen, R.K., Gatto, L.W.

28-3601

REMOTE SENSING, MAPPING, PERMAFROST DISTRIBUTION, VEGETATION PATTERNS, SEDIMENT TRANSPORT.

Physiognomic landscape features were used as geologic and vegetative indicators in preparation of a surficial geology, vegetation, and permafrost map at a scale of 1:1 million using ERTS-1 band 7 imagery. The detail from this map compared favorably with USGS maps at 1:250,000 scale. Physical boundaries mapped from ERTS-1 imagery in combination with ground truth obtained from existing small scale maps and other sources resulted in improved and more detailed maps of permafrost terrain and vegetation for the same area. ERTS-1 imagery provides for the first time, a means of monitoring the following regional estuarine processes: daily and periodic surface water circulation patterns, changes in the relative sediment load of rivers discharging into the inlet; and, several local patterns not recognized before, such as a clockwise back eddy offshore from Clam Gulch and a counterclockwise current north of the Forelands. Comparison of ERTS-1 and Mariner imagery has revealed that the thermokarst depressions found on the Alaskan North Slope and polygonal patterns on the Yukon River Delta are possibly analogs to some Martian terrain features.

MP 1004

MORPHOLOGY OF THE NORTH SLOPE.

Walker, H.J., Alaskan arctic tundra. Edited by M.E. Britton. Arctic Institute of North America. Technical paper No.25, Washington, D.C., Sept. 1973, p.49-52, Numerous refs.

28-3606

PERMAFROST STRUCTURE, ARCTIC TOPOGRAPHY, GEOMORPHOLOGY, TUNDRA TERRAIN, CRYOGENIC PROCESSES, PERMAFROST HYDROLOGY, GROUND ICE, PATTERNED GROUND.

MP 1005

PEDOLOGIC INVESTIGATIONS IN NORTHERN ALASKA.

Tedrow, J.C.F., Alaskan arctic tundra. Edited by M.E. Britton. Arctic Institute of North America. Technical paper No.25, Washington, D.C., Sept. 1973, p.93-108, Numerous refs.

28-3607

TUNDRA SOILS, ARCTIC SOILS, RESEARCH PROJECTS.

MP 1006
MICROMETEOROLOGICAL INVESTIGATIONS NEAR THE TUNDRA SURFACE.
Kelley, J.J., Alaskan arctic tundra. Edited by M.E. Britton. Arctic Institute of North America. Technical paper No.25, Washington, D.C., Sept. 1973, p.109-126, Numerous refs.
28-3608
RESEARCH PROJECTS, MICROCLIMATOLOGY, RADIATION BALANCE, TUNDRA SOILS, SOIL CHEMISTRY.

MP 1007
ARCTIC LIMNOLOGY: A REVIEW.
Hobbie, J.E., Alaskan arctic tundra. Edited by M.E. Britton. Arctic Institute of North America. Technical paper No.25, Washington, D.C., Sept. 1973, p.127-168, Numerous refs.
28-3609
LIMNOLOGY, RESEARCH PROJECTS.

MP 1008
VEGETATIVE RESEARCH IN ARCTIC ALASKA.
Johnson, P.L., et al, Alaskan arctic tundra. Edited by M.E. Britton. Arctic Institute of North America. Technical paper No.25, Washington, D.C., Sept. 1973, p.169-198, Numerous refs.
Tieszen, L.L.
28-3610
TUNDRA VEGETATION, ARCTIC VEGETATION, VEGETATION PATTERNS, RESEARCH PROJECTS.

MP 1009
INFLUENCE OF IRREGULARITIES OF THE BED OF AN ICE SHEET ON DEPOSITION RATE OF TILL.
Nobles, L.H., et al, Till: a symposium. Edited by R.P. Goldthwait, Columbus, Ohio State University Press, 1971, p.117-126, 8 refs.
Weertman, J.
28-3686
GLACIAL TILL, GLACIAL DEPOSITS, GLACIAL FEATURES, GLACIER ICE, SEDIMENT TRANSPORT, ICE THERMAL PROPERTIES, GLACIER ABLATION, GLACIER FLOW.

MP 1010
MODEL SIMULATION OF NEAR SHORE ICE DRIFT, DEFORMATION AND THICKNESS.
Hibler, W.D., III, International Conference on Port and Ocean Engineering Under Arctic Conditions, 4th, St. John's, Sep. 26-30, 1977, Memorial University of Newfoundland, 1978, p.33-44, 15 refs.
32-2339
SEA ICE, ICE MODELS, ICE MECHANICS, MATHEMATICAL MODELS.

Simulation results for sea ice drift, deformation and ice thickness variations in the Arctic Basin are presented using a dynamic-thermodynamic model which treats the ice as a rigid plastic continuum. Using available observed atmospheric and oceanic forcing data, numerical model simulations are made over a four year long period employing one day time steps in a finite difference code with a resolution of 125km. Drift, deformation, stress and ice thickness time series from the simulation results in the near shore region off the Alaskan and Canadian North slope are reported and briefly examined in light of available observations.

MP 1011
DIELECTRIC CONSTANT AND REFLECTION COEFFICIENT OF THE SNOW SURFACE AND NEAR-SURFACE INTERNAL LAYERS IN THE MCMURDO ICE SHELF.
Kovacs, A., et al, *Antarctic journal of the United States,* Oct. 1977, 12(4), p.137-138, 9 refs.
Gow, A.J.
32-2107
SNOW SURFACE, SNOW ELECTRICAL PROPERTIES, ICE SHELVES, ICE ELECTRICAL PROPERTIES, RADAR ECHOES, ANTARCTICA—MCMURDO ICE SHELF.

An impulse radar system was used to profile the shape and lateral extent of the brine layer in the McMurdo Ice Shelf. A small antenna was also used to determine if reflective layers could be detected in the upper 5 m of snow. The radiated impulse center frequency was 626 megahertz with an estimated frequency spectrum of 375 and 875 at the -3 decibel points. The measurement technique is described. The study indicates that layers of dielectric discontinuity can be detected at shallow depths in polar snow. The shallow depth at which the internal layers were detected suggests that they represent density variations in the snow, perhaps associated with summer melt features less than 5 mm thick.

MP 1012
ICEBERG THICKNESS PROFILING USING AN IMPULSE RADAR.
Kovacs, A., *Antarctic journal of the United States,* Oct. 1977, 12(4), p.140-142, 5 refs.
32-2109
ICEBERGS, ICE COVER THICKNESS, RADAR ECHOES, MEASURING INSTRUMENTS.

Thickness measurements taken on a 100 to 500 m tabular iceberg in McMurdo Sound using an impulse radar system are discussed and illustrated. Calculated depths of the brine layer at the south and north ends of the iceberg were 13.7 and 17.4 m, respectively. The calculated thickness of the iceberg at station 4.5 and stations 5 through 17 ranged from 90.0 to 60.5 m. The apparent freeboard-to-thickness ratio was 1 to 5.2, which is higher than the 1 to 3.6 freeboard-to-thickness analysis of Gow (1968; F-6274) for antarctic ice shelves of similar thickness. The *data suggest a glacial rather than a shelf origin.*

MP 1013
SUBSURFACE MEASUREMENTS OF THE ROSS ICE SHELF, MCMURDO SOUND, ANTARCTICA.
Kovacs, A., et al, *Antarctic journal of the United States,* Oct. 1977, 12(4), p.146-148, 2 refs.
Gow, A.J.
32-2114
ICE SHELVES, BRINES, ICE COVER THICKNESS, FIRN, ICE COMPOSITION, ANTARCTICA—MCMURDO ICE SHELF.

Depth characteristics, lateral continuity, and inland boundary of sea water infiltration in the McMurdo Ice Shelf were monitored using a dual-antenna impulse radar profiler. The studies have provided new information on the brine infiltration zone, including data on changes in the elevation of the brine-soaked layer and ice shelf thickness as a function of distance from the shelf edge. The features of the brine layer are described and illustrated. Observations on the glacial ice/saline-ice transition on the Koettlitz Glacier tongue are summarized.

MP 1014
SEA ICE STUDIES IN THE WEDDELL SEA REGION ABOARD USCGC *BURTON ISLAND*.
Ackley, S.F., *Antarctic journal of the United States,* Oct. 1977, 12(4), p.172-173, 2 refs.
32-2123
SEA ICE DISTRIBUTION, ICE COVER THICKNESS, PACK ICE, ICE SALINITY, WEDDELL SEA.

Sea ice studies in the Weddell Sea aboard *Burton Island* consisted of ice salinity measurements on meltwater from ice cores and thickness measurements taken in drilled holes. Floes in the northern region were generally thicker than 2 m and in two regions exceeded 3 m on average. At higher latitudes in the middle of the Weddell Sea ice thicknesses *exceeded 3.5 m. The thinnest ice was measured at the* southernmost locations. It is concluded that advection is an important component in accounting for ice distribution in the Weddell Sea. *In vivo* fluorescence measurements of core meltwater revealed apparent relationships between ice salinity and biological activity (ice algae).

MP 1015
ENGINEERING PROPERTIES OF SNOW.
Mellor, M., *Journal of glaciology,* 1977, 19(81), p.15-66, In English with French and German summaries. Refs. p.62-65.
32-2434
SNOW IMPURITIES, SNOW MECHANICS, SNOW THERMAL PROPERTIES, SNOW ELECTRICAL PROPERTIES, SNOW OPTICS, ENGINEERING, SNOW CRYSTALS, SNOWFALL, BLOWING SNOW.

The general properties of snow are described with a view to engineering applications of data. Following an introduction and a short note on the origins of snow, data are given for fall velocities of snow particles, and for mass flux and particle concentrations in falling snow and blowing snow. Notes on the structural properties of deposited snow cover grain size, grain bonds, bulk density, overburden pressure, and permeability. A section on impurities deals with stable and radioactive isotopes, chemical impurities, insoluble particles, living organisms, acidity, and gases. Mechanical properties are treated only selectively, and the reader is referred to another paper for comprehensive coverage. The selective treatment deals with stress waves and strain waves, compressibility, effects of volumetric strain on deviatoric strain, and specific energy for comminution. The section on thermal properties covers heat capacity, latent heat, conductivity, diffusivity, heat transfer by vapor diffusion, heat transfer and vapor transport with forced convection, and thermal strain. The section on electrical properties opens with a brief discussion on dielectric properties of ice, and proceeds to a summary of the dielectric properties of snow, including dielectric dispersion, permittivity, dielectric loss, and d.c. conductivity. There are also notes on the thermoelectric effect and on electrical charges in falling and blowing snow. The section on optical properties deals with transmission and attenuation of visible radiation, with spectral reflectance, and with long-wave emissivity. The review concludes with some comments on engineering problems that involve snow, and the requirements for research and development. (Auth.)

MP 1016
STRUCTURES IN ICE INFESTED WATER.
Assur, A., 1972, [Vol.2], Symposium on Ice and its Action on Hydraulic Structures, 2nd, Leningrad, Sept. 26-29, 1972. Papers, p.93-97, 7 refs.
28-3899
ICE LOADS, OFFSHORE STRUCTURES, ICE PRESSURE, ICE MODELS.

A method is presented to calculate the effective ice load on vertical structures depending upon width of structure related to ice thickness and fundamental ice properties (anisotropic semirestrained crushing strength, Young's modulus, Poisson's ratio, internal friction). The basic equation satisfies the theoretical identation solution for a straight wall. Both extremes appear as simple intercepts on a plot which futhermore can be linearized. The concept is compared with largely Russian test material and equations which show good agreement. Internal friction must be considered in the *analysis since it increases possible ice forces.* Due to this local identation forces by ice can be higher as previously assumed for the design of ships. Buckling instability introduced complications in model tests. For structures in the field the random configuration of ice collars must be considered. For this a complete solution is still not available.

MP 1017
REPORT ON ICE FALL FROM CLEAR SKY IN GEORGIA OCTOBER 26, 1959.
Harrison, L.P., et al, Washington, D.C., U.S. Weather Bureau, 1960, 31p. plus photographs, 12 refs.
Friedman, I., Saylor, C.P., Swinzow, G.K.
28-3913
ICE STRUCTURE, CHEMICAL ANALYSIS, METEOROLOGICAL FACTORS, AIRPLANES.

The U.S. Weather Bureau, Geological Survey, National Bureau of Standards, National Institutes of Health, and SIPRE investigated the circumstances which resulted in the fall of a 30-40 pound chunk of ice from a clear sky. These agencies concluded that the ice originated from a jet aircraft known to have been flying over the area where the fall was reported. The paper by Swinzow comprises Appendix J of the report.

MP 1018
DESTRUCTION OF ICE ISLANDS WITH EXPLOSIVES.
Mellor, M., et al, International Conference on Port and Ocean Engineering Under Arctic Conditions, 4th, St. John's, Sept. 26-30, 1977, Vol.2, Memorial University of Newfoundland, 1978, p.753-765, 20 refs. See also 31-4112.
Kovacs, A., Hnatiuk, J.
32-2384
ICEBERGS, ICE ISLANDS, EXPLOSION EFFECTS.

Past attempts at explosive demolition of icebergs and ice islands are reviewed, and more recent studies are described. Relevant properties of ice are compared with those of typical rocks, and data are given for crater blasting in ice and in rocks. Ice island destruction is analyzed for schemes involving: (1) crater blasting, (2) blasting in water underneath the ice, (3) bench blasting, and (4) controlled presplit blasting. The analyses favor crater blasting as the most practical method of attack for small bergs and ice islands.

MP 1019
ICEBERG THICKNESS PROFILING.
Kovacs, A., International Conference on Port and Ocean Engineering Under Arctic Conditions, 4th, St. John's, Sept. 26-30, 1977, Vol.2, Memorial University of Newfoundland, 1978, p.766-774, 16 refs.
32-2385
ICEBERGS, ICE COVER THICKNESS, RADAR ECHOES, PROFILES.

Results obtained with an impulse radar system used to profile the thickness of a tabular iceberg in McMurdo Sound, Antarctica, and an ice island in the Beaufort Sea near Flaxman Island, Alaska, are presented. Graphic records are shown of the radar impulse travel time which clearly reveal, for the first time, the bottom relief of each ice formation. Also detected and shown are echo signatures from internal cracks and an infiltration-brine layer. The time of flight of the radar impulse in the ice island is compared with a 24.05-m drill hole measurement of the ice thickness. The effective velocity of the radar impulse in the ice island was found to be 0.16 m/ns and the effective dielectric constant of the ice to be 3.5. (Auth.)

MP 1020
TOWING ICEBERGS.
Lonsdale, H.K., et al, *Bulletin of the Atomic Scientists,* March 1974, 30(3), p.2, Includes response by W.F. Weeks and W.J. Campbell. 2 refs.
Weeks, W.F., Campbell, W.J.
28-3927
ICEBERGS, WATER SUPPLY, LOGISTICS, ICE MELTING, ECONOMICS.

Referring to the article by Weeks and Campbell (1973; F-12650 or 28-898) the author questions the following facets of towing icebergs: the costs of surveillance; the capital costs of the super-tug; the methods of melting, collecting the fresh water on the high seas, and transporting to the Atacama desert or central Australia; and how the total cost compares with the value of water at the intended use site. Weeks and Campbell cite their paper on this subject (1973;

F-12780 or 28-1322) which has included the costs of capitalization and a method of melting and collecting fresh water. It is suggested that surveillance costs would be small, and the authors do not believe their estimates of water costs for irrigation purposes to be unrealistically high.

MP 1021

USE OF EXPLOSIVES IN REMOVING ICE JAMS.

Frankenstein, G.E., et al, Symposium on Ice and its Action on Hydraulic Structures, Reykjavik, Iceland, Sept. 7-10, 1970. Papers and discussions, Reykjavik, Iceland, International Association for Hydraulic Research, 1970, 10p., Session 3.13. 6 refs.

Smith, N.

28-3992

ICE JAMS, ICE CONTROL, EXPLOSIVES, ICE REMOVAL.

A brief history of the use of explosives for ice jam removal is discussed. Ammonium nitrate mixed with fuel oil is considered the best explosive for ice jam control because of its cost and safety features. For maximum effect, the charge should be placed in the water below the ice. A curve is included which gives maximum crater hole diameter as a function of the cube root of the charge weight.

MP 1022

CLASSIFICATION AND VARIATION OF SEA ICE RIDGING IN THE ARCTIC BASIN.

Hibler, W.D., III, et al, *AIDJEX bulletin,* Jan. 1974, No.23, p.127-146, 16 refs.

Mock, S.J., Tucker, W.B.

28-4069

SEA ICE, ICE STRUCTURE, ICE PRESSURE, ICE MODELS, PRESSURE RIDGES.

A one-parameter model for pressure ridges is developed and compared with good agreement to more than 3000 km of laser profile data taken from November 1970 to February 1973 in the Arctic basin. Using a parameter called ridging intensity, which may be determined for a region from the mean number of ridges per unit length and the mean ridge height, the number of ridges per kilometer at any height level may be predicted. Results from a study of regional and temporal variation in ridging indicate that although magnitudes of ridging intensity vary in time, the relative regional variations are similar. Consequently, three distinct regions of ridging intensity having relatively stable boundaries can be defined. Annual variation in new ice production due to ridging is sufficiently large to suggest that ridging plays an important role in the overall mass balance of the Arctic basin.

MP 1023

SALINITY VARIATIONS IN SEA ICE.

Cox, G.F.N., et al, *Journal of glaciology,* 1974, 13(67), p.109-122, In English with French and German summaries. 3 refs.

Weeks, W.F.

29-72

SEA ICE, CHEMICAL ANALYSIS, SALINITY, ICE COVER THICKNESS.

The salinity distribution in multi-year sea ice is dependent on the ice topography and cannot be adequately represented by a single average profile. The cores collected from areas beneath surface hummocks generally showed a systematic increase in salinity with depth from 0 per mille at the surface to about 4 per mille at the base. The cores collected from areas beneath surface depressions were much more saline and displayed large salinity fluctuations. Salinity observations from sea ice of varying thicknesses and ages collected at various Arctic and sub-Antarctic locations revealed a strong correlation between the average salinity of the ice S and the ice thickness h. For salinity samples collected from cold sea ice at the end of the growth season, this relationship can be represented by two linear equations: $S = 14.24 - 19.39\ h\ (h < 0.4\ m)$; $S = 7.88 - 1.59\ h\ (h > 0.4\ m)$. It is suggested that the pronounced break in slope at 0.4 m is due to a change in the dominant brine drainage mechanism from brine expulsion to gravity drainage. A linear regression for the data collected during the melt season gives $S = 1.58 + 0.18\ h$. An annual cyclic variation of the mean salinity exists for multi-year sea ice. The mean salinity reaches a maximum at the end of the growth season and a minimum at the end of the melt season.

MP 1024

ICE FORCES ON VERTICAL PILES.

Nevel, D.E., et al, U.S. Army Science Conference, West Point, N.Y., June 20-23, 1972. Proceedings. Vol. III, Washington, D.C., U.S. Army Research and Development Office, 1972, p.104-114, AD-750 358, 16 refs.

Perham, R.E., Hogue, G.B.

29-121

SEA ICE, ICE PRESSURE, PILE STRUCTURES.

The force that floating ice sheets can exert on vertical piles is important to the design of both military and civilian structures. Present design codes call for 400 psi as the crushing strength of ice without regard to the influencing factors and their variation. The forces which drive the ice into the structure can be water currents, wind, or thermal expansion. These driving forces may be large enough to cause the ice to fail at or near the surface. The purpose of this research is to define this limiting force level and gain a better understanding of the failure process in the ice. (Auth.)

MP 1025

WATER PERCOLATION THROUGH HOMOGENEOUS SNOW.

Colbeck, S.C., et al, The role of snow and ice in hydrology; proceedings of the Banff Symposia, Sept. 1972, Vol.1, Geneva, Switzerland, WMO-IAHS, Unesco, 1973, p.242-257, With French summary. 7 refs. Includes discussions.

Davidson, G.

29-211

SNOW WATER CONTENT, SNOWMELT, SNOW COVER STRUCTURE, SNOW PERMEABILITY.

The gravity flow theory of water percolation through snow is generalized to include any power law relationship between permeability to the water phase and effective water saturation. Experimental observations of water percolation through homogeneous snow are described. It is found that the exponent in the power law is about 3 for homogeneous snow. The theory is used to construct diurnal meltwater waves and these compare favorably with the observed waves. The differences between the results found for natural snow and those found for repacked snow are discussed. The lower limit of applicability of the gravity flow theory is uncertain.

MP 1026

SEASONAL REGIME AND HYDROLOGICAL SIGNIFICANCE OF STREAM ICINGS IN CENTRAL ALASKA.

Kane, D.L., et al, The role of snow and ice in hydrology; proceedings of the Banff Symposia, Sept. 1972, Vol.1, Geneva, Switzerland, WMO-IAHS, Unesco, 1973, p.528-540, With French summary. 16 refs. Includes discussions.

Slaughter, C.W.

29-232

RIVER ICE, FREEZEUP, ICE FORMATION, AERIAL PHOTOGRAPHY, METEOROLOGICAL FACTORS, HYDROLOGIC CYCLE.

Many streams in Arctic and sub-Arctic regions are characterized by accumulations of ice in the channel and nearby floodplain during the winter months. Field data on the rates of growth of this icing and on various climatic factors has been collected at a small research watershed near Fairbanks, Alaska. The volume of icing growths is estimated from aerial photographs. Hydrologic implications are derived by comparing the volume of these icings with other elements of the hydrologic cycle. Discussion on how the hydrologic cycle is modified by these ice accumulations is also included.

MP 1027

MEASURING THE UNIAXIAL COMPRESSIVE STRENGTH OF ICE.

Haynes, F.D., et al, *Journal of glaciology,* 1977, 19(81), p.213-223, In English with French and German summaries. 7 refs.

Mellor, M.

32-2445

ICE COMPRESSION, COMPRESSIVE STRENGTH, ICE STRENGTH, SHEAR STRESS, ICE CRYSTALS, MEASURING INSTRUMENTS.

An attempt was made to develop a simple but accurate method for making compressive strength tests on right circular cylinders. Compliant loading platens were designed to apply uniform normal stress without introducing significant interface radial shear stresses. The compliant platens gave reproducible results that agree well with results obtained by a precise conventional technique. Accurate results were obtained with simple specimen preparation, and with short specimens where the length-to-diameter ratio was less than unity. Platens were made from a rubber-like urethane which was molded in aluminum cylinders to provide lateral restraint. Uniaxial compression tests on cylindrical polycrystalline ice specimens were made to determine the characteristics of the platens. For 21 specimens with ends prepared on a lapping plate to obtain a mirror finish, the measured strength showed a variation of only 13% for length-to-diameter ratios from 0.74 to 2.5, with no systematic trend. Another 21 specimens with length-to-diameter ratios of about 2.35 were tested with various platens and various methods of specimen end preparation. The strength for specimens with saw-cut ends and for those with ends lapped showed very little difference when tested with the rubber platens.

MP 1028

INVESTIGATION OF AUTOMATIC DATA COLLECTION EQUIPMENT FOR OCEANOGRAPHIC APPLICATIONS.

Dean, A.M., Jr., International Conference on Port and Ocean Engineering Under Arctic Conditions, 4th, St. John's, Sept. 26-30, 1977, Vol.2, Memorial University of Newfoundland, 1978, p.1111-1121, 13 refs.

32-2407

REMOTE SENSING, MONITORS, OCEANOGRAPHY, DATA PROCESSING, METEOROLOGICAL DATA.

This paper deals with the instrumentation requirements for in-situ monitoring of specified factors in open water. It contains application information suitable for an organization initiating or extending an oceanographic data collection program. The analysis includes an investigation and evaluation of sensing methodology, sensors, monitoring equipment, and available data collection systems. A comparison of available equipment for a first-year effort is presented.

MP 1029

MESOSCALE MEASUREMENT OF SNOW-COVER PROPERTIES.

Bilello, M.A., et al, The role of snow and ice in hydrology; proceedings of the Banff Symposia, Sept. 1972, Vol.1, Geneva, Switzerland, WMO-IAHS, Unesco, 1973, p.624-643, With French summary. 16 refs.

Bates, R.E., Riley, J.

29-241

SNOW DEPTH, SNOW DENSITY, METEOROLOGICAL FACTORS, SNOW TEMPERATURE.

Physical characteristics of the snow cover and associated meteorological conditions were observed at nineteen sites in and around Fort Greely, Alaska, during the winter of 1966-67. Snowfall totaled 245 cm and maximum snow depths of 80 to 100 cm were observed in a major portion of Fort Greely. Measurements at nine sites showed the snow density to be light; for example, the average density in the forest was less than 0.24 g/cc. However, exceptions could be expected as observed at Jarvis Creek, where the density averaged 0.33 g/cc. Daily temperature measurements made within the snow pack also showed that the snow in the forest was colder than that at exposed sites. Associations between snow cover properties and weather were tested and the results substantiated previous studies, which showed good relationships between seasonal snow cover density and windspeed/air temperatures.

MP 1030

ARCTIC AND SUBARCTIC ENVIRONMENTAL ANALYSES UTILIZING ERTS-1 IMAGERY. BIMONTHLY PROGRESS REPORT, 23 AUG. - 23 OCT. 1973.

Anderson, D.M., et al, *U.S. National Aeronautics and Space Administration. Contractor report,* Oct. 23, 1973, NASA-CR-135846, 3p., N74-11146.

McKim, H.L., Haugen, R.K., Gatto, L.W., Slaughter, C.W., Marlar, T.L.

29-535

REMOTE SENSING, ERTS IMAGERY.

MP 1031

ARCTIC AND SUBARCTIC ENVIRONMENTAL ANALYSES UTILIZING ERTS-1 IMAGERY. BIMONTHLY PROGRESS REPORT, 23 OCT. - 23 DEC. 1973.

Anderson, D.M., et al, *U.S. National Aeronautics and Space Administration. Contractor report,* Dec. 23, 1973, NASA-CR-136293, 6p., N74-14034.

McKim, H.L., Haugen, R.K., Gatto, L.W., Slaughter, C.W., Marlar, T.L.

29-553

REMOTE SENSING, ENVIRONMENTS, ERTS IMAGERY.

MP 1032

RESULTS OF THE US CONTRIBUTION TO THE JOINT US/USSR BERING SEA EXPERIMENT.

Campbell, W.J., et al, *U.S. National Aeronautics and Space Administration. Technical memorandum,* May 1974, NASA-TM-X-70648, 197p., N74-22971, Refs.

Chang, T.C., Fowler, M.G., Gloersen, P., Ramseier, R.O., Kuhn, P.M., Ross, D.B., Stambach, G., Webster, W.J., Jr., Wilheit, T.T.

29-902

SEA ICE, ICE MECHANICS, ICE STRUCTURE, DRIFT, METEOROLOGICAL FACTORS.

The atmospheric circulation which occurred during the Bering Sea Experiment, 15 February to 10 March 1973, in and around the experiment area is analyzed and related to the macroscale morphology and dynamics of the sea ice cover. The ice cover was very complex in structure, being made up of five ice types, and underwent strong dynamic activity. Synoptic analyses show that an optimum variety of weather situations occurred during the experiment: an initial strong anticyclonic period (6 days), followed by a period of strong cyclonic activity (6 days), followed by weak anticyclonic activity (3 days), and finally a period of weak cyclonic activity (4 days). The data of the mesoscale test areas observed on the four sea ice option flights, and ship weather, and drift data give a detailed description of mesoscale ice dynamics which correlates well with the macroscale view: anticyclonic activity advects the ice southward with strong ice divergence and a regular lead and polynya pattern; cyclonic activity advects the ice northward with ice convergence, or slight divergence, and a random lead and polynya pattern. (Auth.)

MP 1033

PROPANE DISPENSER FOR COLD FOG DISSIPATION SYSTEM.

Hicks, J.R., et al, U.S. Air Force Electrical Systems Division, L.G. Hanscomb Field, Mass., ESD-TR-73-208, Hanover, New Hampshire, Cold Regions Research and Engineering Laboratory, 1973, 38p., AD-762 292, Includes as App. B, Evaluation of cloud seeding with liquefied propane by Veal and Auer. 4 refs.
Lukow, T.E., Veal, D.L., Auer, A.H., Jr.
29-1286
FOG DISPERSAL, AIRCRAFT LANDING AREAS, AEROSOLS, SMOKE GENERATORS, COST ANALYSIS.

MP 1034

ICE-CRATERING EXPERIMENTS BLAIR LAKE, ALASKA.

Kurtz, M.K., et al, *U.S. Army Engineer Nuclear Cratering Group, Livermore, Calif. Technical memorandum,* Nov. 25, 1966, NCG/TM 66-7, Various pagings, No microfiche available.
Benfer, R.H., Christopher, W.G., Frankenstein, G.E., Van Wyhe, G., Roguski, E.A.
29-1921
LAKE ICE, EXPLOSION EFFECTS, ICE BREAKUP.

Operation BREAKUP, FY 66, was a series of small, single and row charge, chemical explosive detonations fired in fresh water to crater the overlying sheet ice. The experiments were conducted in the winter of 1966 under three feet of ice at Blair Lake, 33 miles SSE of Fairbanks, Alaska. The operation had the following purposes: (1) to determine the cratering effects of single and row charges detonated below an ice layer; (2) to study bubble coalescence; and (3) to support theoretical studies of cratering physics. Technical programs included crater measurements, ice surface motion, engineering properties, and fish surveys. Some results and conclusions were: (1) the relationship between depth of detonation and ice crater radius has been defined for 136 pound C4 spherical charges for various experimental conditions; (2) shock wave reflection from the lake bottom did not appear to enhance the crater dimensions; (3) row charge crater dimensions were defined for three charge spacings; (4) cracks appeared to propagate better from larger yield explosions under ice of the same thickness; (5) there did not appear to be any evidence of bubble coalescence in the experiments; (6) commonly used scaling laws may be used to estimate the effects of higher yield ice creating explosions; (7) the procedures used are adaptable to civil application; (8) a detailed evaluation was made of the effects of under-ice explosions on fish; and (9) maintenance of open water gaps created by explosions is affected by refreezing and water currents. Examples of practical engineering applications of the BREAKUP results are included.

MP 1035

MESO-SCALE STRAIN MEASUREMENTS ON THE BEAUFOURT SEA PACK ICE (AIDJEX 1971).

Hibler, W.D., III, et al, *Problemy Arktiki i Antarktiki; Sbornik statei,* 1974, Vol.43-44, p.119-138, In Russian. 21 refs.
Weeks, W.F., Ackley, S.F., Kovacs, A., Campbell, W.J.
29-2023
PACK ICE, ICE DEFORMATION, DRIFT, AERIAL RECONNAISSANCE, ICE REPORTING, AERIAL PHOTOGRAPHS.

MP 1036

LAND TREATMENT OF WASTEWATERS.

Reed, S.C., et al, *Army research and development,* Nov.-Dec. 1974, p.12-13.
Buzzell, T.D.
29-2193
WASTE TREATMENT, SEEPAGE, SURFACE DRAINAGE.

MP 1037

USE OF DE-ICING SALT—POSSIBLE ENVIRONMENTAL IMPACT.

Minsk, L.D., *Highway research record,* 1973, No.425, p.1-2.
29-2220
CHEMICAL ICE PREVENTION, SALTING.

Humorous introduction to a series of 8 reports on various aspects of salting.

MP 1038

DEPTH OF WATER-FILLED CREVASSES THAT ARE CLOSELY SPACED.

Robin, G. de Q., et al, *Journal of glaciology,* 1974, 13(69), p.543-544, Robin's comments on Weertman's article "Can a water-filled crevasse reach the bottom surface of a glacier?" and Weertman's reply. 5 refs.
Weertman, J.
29-2424
GLACIER ICE, CREVASSES, UNFROZEN WATER CONTENT, ATMOSPHERIC PRESSURE.

MP 1039

NEW ENGLAND RESERVOIR MANAGEMENT: LAND USE/VEGETATION MAPPING IN RESERVOIR MANAGEMENT (MERRIMACK RIVER BASIN).

Cooper, S., et al, *U.S. National Aeronautics and Space Administration. Contractor report,* June 14, 1974, NASA-CR-139239, 30p., E74-10669.
McKim, H.L., Gatto, L.W., Merry, C.J., Anderson, D.M.
29-2456
REMOTE SENSING, AERIAL PHOTOGRAPHY, VEGETATION PATTERNS, MAPPING.

It is evident from this comparison that for land use/vegetation mapping the S190B Skylab photography compares favorably with the RB-57 photography and is much superior to the ERTS-1 and Skylab 190A imagery. For most purposes the 12.5 meter resolution of the S190B imagery is sufficient to permit extraction of the information required for rapid land use and vegetation surveys necessary in the management of reservoir or watershed. The ERTS-1 and S190A data products are not considered adequate for this purpose, although they are useful for rapid regional surveys at the level 1 category of the land use/vegetation classification system.

MP 1040

REMOTE SENSING PROGRAM REQUIRED FOR THE AIDJEX MODEL.

Weeks, W.F., et al, *Arctic Ice Dynamics Joint Experiment. AIDJEX bulletin,* Nov. 1974, No.27, p.22-44, 18 refs.
Coon, M.D., Campbell, W.J.
29-2683
RESEARCH PROJECTS, SEA ICE, REMOTE SENSING, ICE MODELS, ICE COVER THICKNESS, STRAINS, SURFACE ROUGHNESS, AERIAL PHOTOGRAPHS, MEASURING INSTRUMENTS.

MP 1041

INVESTIGATION OF ICE FORCES ON VERTICAL STRUCTURES.

Hirayama, K., et al, *Iowa. University. Institute of Hydraulic Research. IIHR report,* June 1974, No.158, 153p., 57 refs.
Schwarz, J., Wu, H.-C.
29-2975
ICE LOADS, OFFSHORE STRUCTURES, ICE CRACKS, FRACTURE ZONES, TENSILE STRENGTH, PILE STRUCTURES, STRAIN TESTS.

The Iowa Institute of Hydraulic Research has undertaken model studies on the investigation of ice forces on vertical piles. Model techniques for the study of ice-breaking phenomena have been developed, and the similarity between the model indications and prototype conditions has been demonstrated. Tests on the relationships between ice forces (ice strength) and pile diameter, ice thickness, and relative velocity (strain rate) between ice and structure have been completed. The experimental results were satisfactorily explained by a theoretical approach, and the combination of these relationships led to a basic empirical formula for the calculation of the maximum penetration strength for a circular pile, which agrees with available field measurements and also in part with model investigations in Russia. The suggested formula was modified for application to different structural shapes and degree of contact between ice and structure as well as for application to the indentation case of pile-ice interaction.

MP 1042

STABILITY OF ANTARCTIC ICE.

Weertman, J., *Nature,* Jan. 17, 1975, 253(5488), p.159.
29-3124
ICE SHEETS, ICE SHELVES, FLOW RATE, ICE COVER THICKNESS, ANTARCTICA—ROSS ICE SHELF.

The author comments on the continued existence of the apparently unstable West Antarctic Ice Sheet and Ross Ice Shelf. The new field data on the Ross Ice Shelf and fast moving ice streams obtained by G. Robin (29-3125 or F-14813) is considered essential to the future solution of this geophysical puzzle. It is possible that the West Antarctic Ice Sheet is indeed disintegrating as suggested by T. Hughes (29-0067 or F-12956). A more accurate answer to this question should be obtainable from a three dimensional glacier mechanics analysis carried out with the aid of computer calculations or with field observations. It is hoped that Robin's data on ice streams may also help to solve the problem of why fast moving ice streams form near the edge of the West Antarctic Ice Sheet.

MP 1043

SOIL PROPERTIES OF THE INTERNATIONAL TUNDRA BIOME SITES.

Brown, J., et al, International Biological Programme Tundra Biome. Microbiology, Decomposition and Invertebrate Working Groups. Meeting, University of Alaska, Fairbanks, August 1973. Proceedings (Soil organisms and decomposition in tundra), Stockholm Sweden, International Biological Program, Tundra Biome Steering Committee, 1974, p.27-48, 31 refs.
Veum, A.K.
29-3348
TUNDRA SOILS, SOIL COMPOSITION, SOIL CHEMISTRY, TUNDRA BIOME, SOUTH GEORGIA, SIGNY ISLAND, MACQUARIE ISLAND.

The soils of the national Tundra Biome sites, which include subantarctic locations, reflect a significantly wide range of soil-forming factors and conditions. It is the purpose of this report to present the most representative set or sets of soil data available for each national project. Presentation of data is confined to the upper three to four soil layers or horizons since these are the most biologically significant for purposes of this volume and other Tundra Biome synthesis activities. The main emphasis here is to provide physical, chemical and thermal soils properties which supplement data presented elsewhere in this volume and which are required for subsequent interpretations of those reports. A brief summary of major soil conditions at each site is given in order to provide the uninitiated reader with a cursory understanding of the soil physical environment.

MP 1044

CAN A WATER-FILLED CREVASSE REACH THE BOTTOM SURFACE OF A GLACIER?.

Weertman, J., *International Association of Scientific Hydrology. Publication,* 1973, No.95, p.139-145, 7 refs., In English with French summary.
29-3729
CREVASSES, SUBGLACIAL DRAINAGE, PENETRATION, TENSILE STRESS, ICE PRESSURE, ANALYSIS (MATHEMATICS), CREEP PROPERTIES, MAGMA.

MP 1045

ELECTRICAL RESISTIVITY PROFILE OF PERMAFROST.

Hoekstra, P., *National Research Council, Canada. Associate Committee on Geotechnical Research. Technical memorandum,* Nov. 1974, No.113, p.28-34, 6 refs.
30-806
ELECTRICAL RESISTIVITY, PERMAFROST STRUCTURE, DIELECTRIC PROPERTIES, UNFROZEN WATER CONTENT.

MP 1046

AIRBORNE E-PHASE RESISTIVITY SURVEYS OF PERMAFROST - CENTRAL ALASKA AND MACKENZIE RIVER AREAS.

Sellmann, P.V., et al, *National Research Council, Canada. Associate Committee on Geotechnical Research. Technical memorandum,* Nov. 1974, No.113, p.67-71.
McNeill, J.D., Scott, W.J.
30-810
PERMAFROST INDICATORS, ELECTRICAL RESISTIVITY, AIRBORNE EQUIPMENT, SURFACE STRUCTURE, DISCONTINUOUS PERMAFROST.

MP 1047

ARCTIC AND SUBARCTIC ENVIRONMENTAL ANALYSIS UTILIZING ERTS-1 IMAGERY. FINAL REPORT JUNE 1972-FEB. 1974.

Anderson, D.M., et al, *U.S. National Aeronautics and Space Administration. Contractor report,* Feb. 28, 1974, NASA-CR-142538, 128p.
McKim, H.L., Gatto, L.W., Haugen, R.K., Crowder, W.K., Slaughter, C.W., Marlar, T.L.
30-1296
RIVER FLOW, SEDIMENTS, PERMAFROST DISTRIBUTION, SNOW COVER, RIVER ICE, SEA ICE, MAPPING, REMOTE SENSING, ERTS IMAGERY.

The author has identified the following significant results. ERTS-1 imagery provides a means of distinguishing and monitoring estuarine surface water circulation patterns and changes in the relative sediment load of discharging rivers on a regional basis. Physical boundaries mapped from ERTS-1 imagery in combination with ground truth obtained from existing small scale maps and other sources resulted in improved and more detailed maps of permafrost terrain and vegetation for the same area. Snowpack cover within a research watershed has been analyzed and compared to ground data. Large river icings along the proposed Alaska pipeline route from Prudhoe Bay to the Brooks Range have been monitored. Sea ice deformation and drift northeast of Point Barrow, Alaska have been measured during a four day period in March and shore-fast ice accumulation and ablation along the west coast of Alaska have been mapped for the spring and early summer seasons.

MP 1048

WASTE MANAGEMENT IN THE NORTH.

Rice, E., et al, *Northern engineer,* Winter 1974-75, 6(4), p.14-21.
Alter, A.J.
30-1598
WASTE TREATMENT, SEWAGE TREATMENT, SANITARY ENGINEERING.

MP 1049

ELECTRICAL GROUND IMPEDANCE MEASUREMENTS IN ALASKAN PERMAFROST REGIONS.

Hoekstra, P., *U.S. Federal Aviation Administration. Research and development report,* April, 1975, FAA-RD-75-25, 60p., ADA-011 458, 18 refs.
30-1855
ELECTRICAL RESISTIVITY, WAVE PROPAGATION, PERMAFROST DEPTH, PERMAFROST THICKNESS, RADIO WAVES.

New results about ground conductivity in North America became available from geophysical studies near Fairbanks, from sites along the Alaska Pipeline and in several areas of the Canadian Arctic; at these locations ground and/or airborne conductivity measurements were made by measuring the wavetilt and/or the surface impedance of radio groundwaves. The results showed that the ground conductivity in permafrost areas of North America is very heterogeneous, so that it is not directly apparent how to assign an effective conductivity value to a path of practical length (approx. 100 km). The geological and permafrost conditions vary much in Alaska, so that measurements at a location are representative of a small area only, leaving large areas of Alaska open to question. Theoretical evaluations of the seasonal changes in ground conductivity and their effect on radiowave propagation and electrical grounding are also discussed.

MP 1050

BARROW, ALASKA, USA.

Bunnell, F.L., et al, *Sweden. Statens naturvetenskapliga forskningsrad. NFR ecological bulletins,* 1975, No.20, International Meeting on Biological Productivity of Tundra, 5th: IBP Tundra Biome, Abisko, Sweden, April 16-24, 1974. Structure and function of tundra ecosystems, edited by T. Rosswall and O.W. Heal, p.73-124, 79 refs.
MacLean, S.F., Jr., Brown, J.
30-2199
TUNDRA CLIMATE, SOLAR RADIATION, SNOWMELT, TUNDRA VEGETATION, MOSSES, LICHENS, SOIL COMPOSITION, UNITED STATES—ALASKA—BARROW.

MP 1051

RADIATION AND EVAPORATION HEAT LOSS DURING ICE FOG CONDITIONS.

McFadden, T., *National Research Council, Canada. Associate Committee on Geotechnical Research. Technical memorandum,* Jan. 1975, No.114, p.18-27, 8 refs.
30-2552
ICE FOG, HEAT LOSS, EVAPORATION, WATER TEMPERATURE, RADIATION, WIND (METEOROLOGY), UNITED STATES—ALASKA.

MP 1052

C-14 AND OTHER ISOTOPE STUDIES ON NATURAL ICE.

Oeschger, H., et al, International conference on radiocarbon dating, 8th, Oct. 18-25, 1972. Proceedings. Vol. 1, Wellington, Royal Society of New Zealand, 1972, p.D70-D92, 26 refs.
Stauffer, B., Bucher, P., Frommer, H., Moll, M., Langway, C.C., Jr., Hansen, B.L., Clausen, H.B.
30-3086
ICE DATING, ISOTOPE ANALYSIS, GLACIER ICE.

On several field projects in Greenland, Antarctica and the Swiss Alps, the extraction technique of traces from several tons of ice has been developed and perfected. The procedures are as follows. Surface ice samples are melted in vacuum melt vessels, whereas in bore holes the ice is melted *in situ* under vacuum at the desired depth. Until now the maximum depth from which samples have been extracted is 780 m. The gases escaping during the melting process are pumped through a molecular sieve for drying and collection of CO2. The remaining gases are compressed for further treatment in the laboratory. Soluble chemistry may be carried out either on the melt water pumped to the surface (collection of Si) or down hole by circulating the melt water through ion exchange resins (collection of CO2). The melt water can be filtered for the collection of pollen, terrestrial and cosmic dust. Uncontaminated CO2, Ar and Si samples can be obtained for radioisotopic dating. The results of the Si-32 samples allow us to establish an apparent half-life for Si-32 dating. The possible causes of the C-14 variations are discussed and ways to solve the problem suggested. (Auth.)

MP 1053

ECOLOGICAL INVESTIGATIONS OF THE TUNDRA BIOME IN THE PRUDHOE BAY REGION, ALASKA.

Brown, J., ed, *Alaska. University. Biological papers,* Oct. 1975, No.2, 215p., For selected papers see 30-3305 through 30-3313. Numerous refs.
30-3304
TUNDRA SOILS, TUNDRA VEGETATION, SNOW COVER, ANIMALS, TUNDRA BIOME, UNITED STATES—ALASKA—PRUDHOE BAY.

During the period 1970-1974, the U.S. Tundra Biome Program, which was stationed primarily out of Barrow, performed a series of environmental and terrestrial ecological studies at Prudhoe Bay. This volume reports specifically on the Prudhoe results and is divided into three major subdivisions: (1) abiotic and soil investigations; (2) plant investigations, and (3) animal investigations. The abiotic section contains papers on the air and soil temperature regimes; the snow cover, particularly its properties adjacent to the roadnet; major soil and landform associations, and the chemical composition of soils, runoff, lakes, and rivers. The plant section contains reports on a general vegetation survey; a follow-up vegetation mapping project, and a study of the growth of arctic, boreal, and alpine biotypes in an experimental transplant garden. The animal section contains reports on the tundra invertebrates; the bird, lemming, and fox populations, and the behavioral and physiological investigations of caribou and several experimental reindeer. Appendices contain a checklist of the vascular, bryophyte, and lichen flora of the Prudhoe Bay area and selected data on vegetation. Several of the papers draw comparisons with the Barrow tundra. The volume includes a considerable number of tables in its attempt to document for the first time the abiotic, flora, and fauna of this relatively unknown arctic tundra landscape.

MP 1054

SELECTED CLIMATIC AND SOIL THERMAL CHARACTERISTICS OF THE PRUDHOE BAY REGION.

Brown, J., et al, *Alaska. University. Biological papers,* Oct. 1975, No.2, p.3-12, 7 refs.
Haugen, R.K., Parrish, S.
30-3305
TUNDRA SOILS, CLIMATE, AIR TEMPERATURE, SOIL TEMPERATURE, UNITED STATES—ALASKA—PRUDHOE BAY.

MP 1055

NEAR REAL TIME HYDROLOGIC DATA ACQUISITION UTILIZING THE LANDSAT SYSTEM.

McKim, H.L., et al, Conference on soil-water problems in cold regions, Calgary, Alberta, Canada, May 6-7, 1975, Proceedings, 1975, p.200-211, 4 refs.
Anderson, D.M., Berg, R.L., Tuinstra, R.L.
30-3342
REMOTE SENSING, SPACECRAFT, DATA TRANSMISSION, MEASURING INSTRUMENTS, LANDSAT.

The LANDSAT Data Collection System (DCS) provides the capability of rapidly collecting hydrologic, meteorologic and environmental data at remote sites throughout the United States and Canada. The coded signals are transmitted via satellite to NASA ground receiving stations where the data are compiled and teletyped to the user. The number of transmissions per day varies considerably depending on the location of each data collection platform (DCP). During the past two years, many sensors have been interfaced to the DCP; one of the most important is a porous cup tensiometer constructed so that a transducer provides a continuous reading of pore water pressure. Field tests have shown that the transmissions from the DCP are accurate and reliable. This system appears to provide a reliable means of measuring pore water pressure at freeze-up and thaw, critical data needed for validation of current hydrologic models.

MP 1056

GLACIOLOGY'S GRAND UNSOLVED PROBLEM.

Weertman, J., *Nature,* Mar. 25, 1976, 260(5549), p.284-286.
30-3369
ICE SHEETS, GLACIER OSCILLATION, ICE SHELVES, SEA LEVEL.

Glaciology's grand unsolved problem, or set of interrelated problems, concerns the West Antarctic Ice Sheet: how it formed, whether it it growing or disintegrating, why fast moving ice streams form at its periphery, etc. Geological evidence indicates that before 10,000 yr ago the West Antarctic Ice Sheet was much larger, covering the area, now below sea level, presently occupied by the Ross Ice Shelf and that a large scale retreat took place at its edge. The retreat was probably caused by the large rise in sea level that occurred when the ice sheets in the northern hemisphere melted at the end of the last ice age. It has been suggested that the West Antarctic Ice Sheet is still disintegrating, its edge retreating where it joins the Ross Ice Shelf on the order of 70 m/yr. This slowly occurring destruction could account for the present rate of rise of the mean sea level. Recent data collected on the Ross Ice Shelf reaches the startling conclusion that the position of the edge of the ice sheet at least at one location is advancing at the very fast rate of 1 km/yr. Extensive field data will be required to determine whether the ice sheet is disintegrating or growing and at what rate.

MP 1057

MECHANICAL PROPERTIES OF SNOW USED AS CONSTRUCTION MATERIAL.

Wuori, A.F., *Leningrad. Arkticheskiĭ i antarkticheskiĭ nauchno-issledovatel'skiĭ institut. Trudy,* 1975, Vol.326, p.157-164, In Russian. 14 refs.
30-3626
SNOW (CONSTRUCTION MATERIAL), SNOW ROADS, ICE ROADS, ICE RUNWAYS, SNOW MECHANICS, SNOW COMPACTION, SNOW BEARING STRENGTH, TESTS.

Various methods are feasible for processing snow into a construction material in polar areas where conventional materials are uneconomical or impractical. This conversion necessitates considerable alteration of the mechanical properties of snow; this study is concerned with these alterations. The problems of compacting snow for road, airstrip and building construction are examined.

MP 1058

METHODS OF MEASURING THE STRENGTH OF NATURAL AND PROCESSED SNOW.

Abele, G., *Leningrad. Arkticheskiĭ i antarkticheskiĭ nauchno-issledovatel'skiĭ institut. Trudy,* 1975, Vol.326, p.176-186, In Russian. 14 refs.
30-3629
SNOW (CONSTRUCTION MATERIAL), ICE RUNWAYS, SNOW COMPACTION, SNOW ROADS, AIRPORTS, SNOW BEARING STRENGTH.

MP 1059

TECHNIQUES FOR USING LANDSAT IMAGERY WITHOUT REFERENCES TO STUDY SEA ICE DRIFT AND DEFORMATION.

Hibler, W.D., III, et al, *Arctic Ice Dynamics Joint Experiment. AIDJEX bulletin,* Mar. 1976, No.31, p.115-135, 12 refs.
Tucker, W.B., Weeks, W.F.
30-3888
SEA ICE, DRIFT, ICE DEFORMATION, POSITION (LOCATION), LANDSAT.

A semi-automatic procedure is described for transferring ice coordinates rapidly and accurately from one LANDSAT image to another and for simultaneously estimating all linear measures of the ice deformation. The procedure takes into account the non-parallel nature of the longitude lines and the finite curvature of the latitude lines, factors which are particularly critical in the polar regions. Necessary inputs are the location coordinates (latitude and longitude) of the center of each image and the location of two arbitraty points on a line of longitude on the image. These equations, which are valid over distances of several hundred kilometers, bypass the complex and time-consuming procedure of projecting points on the spheroid. After the transfer of common ice feature locations (on successive days) is completed, a least-squares program yields the average strain rate and vorticity, with the strain rate being independent of errors in the transfer of the coordinate system. Transfer, vorticity, and strain rate errors of the technique are described.

MP 1060

LABORATORY INVESTIGATION OF THE MECHANICS AND HYDRAULICS OF RIVER ICE JAMS.

Tatinclaux, J.C., et al, *Iowa. University. Iowa Institute of Hydraulic Research. Report,* Mar. 1976, No.186, 97p., 7 refs.
Lee, C.L., Wang, T.P., Nakato, T., Kennedy, J.F.
30-4136
ICE JAMS, RIVER ICE, ICE MECHANICS, HYDRAULICS, COMPRESSIVE STRENGTH, ICE COVER THICKNESS, ICE FLOES, FLOW RATE, EXPERIMENTAL DATA.

MP 1061

ROSS ICE SHELF PROJECT DRILLING, OCTOBER-DECEMBER 1976.

Rand, J.H., *Antarctic journal of the United States,* Oct. 1977, 12(4), p.150-152, 4 refs.
32-2116
ICE SHELVES, ICE CORING DRILLS, DRILLING, ANTARCTICA—ROSS ICE SHELF.

The wire line core drilling system used for the Ross Ice Shelf Project and the problems encountered in using the equipment are described. The proposed plans included drilling four holes: the water well hole, Bern hole, core hole, and access hole. The generally unsuccessful operations during the season indicated that it is not feasible to drill an open hole through the Ross Ice Shelf due to closure of the drilled hole as a result of the flowing characteristics of ice.

MP 1062

CONCENTRATED LOADS ON A FLOATING ICE SHEET.

Nevel, D.E., *Journal of glaciology,* 1977, 19(81), p.237-245, In English with French and German summaries. 8 refs.

32-2447

FLOATING ICE, ICE BEARING CAPACITY, TENSILE STRESS, ICE ELASTICITY, LOADS (FORCES), ICE COVER THICKNESS, MATHEMATICAL MODELS.

The safe bearing capacity of a floating ice sheet is usually determined by limiting the maximum tensile stress which occurs under the load at the bottom of the ice sheet. If the size of the load distribution is large compared to the ice thickness, the thin plate theory predicts these stresses correctly. However, if the size of the load distribution becomes small compared to the ice thickness, the plate theory overestimates the stresses. In this case the ice sheet should be treated as a three-dimensional elastic layer. Previous investigators have solved the elastic-layer problem for loads distributed over a circular area, and have limited the results to the stress at the bottom of the ice sheet directly under the center of the load. In the present paper the stresses are evaluated at any radial position, and it is shown how these stresses approach those for the plate theory as the radial position becomes large. The solutions for the stresses are presented in integral form, as well as graphs from the numerical integration. These new results are significant for the superposition of stresses when two concentrated loads act near each other. Similarly for loads distributed over a rectangular area, the plate theory will overestimate the stresses if the dimensions of the load become small compared to the ice thickness. For this case integral solutions are presented for the stresses, and are evaluated directly under the center of the load. (Auth.)

MP 1063

FLEXURAL STRENGTH OF ICE ON TEMPERATE LAKES.

Gow, A.J., *Journal of glaciology,* 1977, 19(81), p.247-256, In English with French and German summaries. 7 refs.

32-2448

FLEXURAL STRENGTH, LAKE ICE, ICE CRYSTAL STRUCTURE, TENSILE STRESS, ICE CRACKS, TESTS.

Large, simply supported beams of temperate lake ice generally yield significantly higher flexural strengths than the same beams tested in the cantilever mode. Data support the view that a significant stress concentration may exist at the fixed corners of the cantilever beams. Maximum effects are experienced with beams of cold, brittle ice substantially free of structural imperfections; the stress concentration factor may exceed 2.0 in this kind of ice. In ice that has undergone extensive thermal degradation the stress concentration effect may be eliminated entirely. Simply supported beams generally test stronger when the top surface is placed in tension. This behavior is attributed to differences in ice type; the fine-grained, crack-free top layer of snow-ice usually reacting more strongly in tension than the coarse-grained bottom lake ice which is prone to cracking. (Auth.)

MP 1064

DE-ICING OF RADOMES AND LOCK WALLS USING PNEUMATIC DEVICES.

Ackley, S.F., et al, *Journal of glaciology,* 1977, 19(81), p.467-478, In English with French and German summaries. 1 ref.

Itagaki, K., Frank, M.

32-2467

ICE REMOVAL, PNEUMATIC EQUIPMENT, ICE DETECTION, ICE NAVIGATION.

A rough comparison between thermal and mechanical methods of de-icing indicates that mechanical methods could potentially de-ice with an order-of-magnitude less energy than that required to melt an ice accretion. Two applications of mechanical de-icing using pneumatically driven inflatable de-icers are described in this report. The first of these was the de-icing of a small cylindrical radome used for air navigational purposes. Two seasons of testing were conducted with a de-icer consisting of an inflatable-deflatable flexible plastic covering. The de-icer was driven by tanks with pressure and vacuum reservoirs that were recharged by an on-site air compressor in response to a pressure sensor. The de-icing cycle was activated by an ice detector so the system responded to icing events on a demand basis driven by the ice detector. The system proved successful in keeping the radome free of ice without manned operation and with small energy consumption in a mountain icing environment. The second application was an attempt to de-ice the walls of locks used in river navigational facilities. Ice usually formed at the high-water-mark by the freezing of the water exposed to low air temperatures or by the pressing of ice against the walls by ships using the locks. The de-icers consisted of air-driven hoses mounted on the wall covered by a thick flexible rubber mat and protected from ship damage by steel outer plates. This method was successful in removing ice accumulations up to 2 m long by 0.3 m thick over the area covered by the de-icer. Installation costs and the necessity for protection of the de-icer against abrasion by ships may make this de-icing method prohibitively expensive compared with methods which are not as susceptible to damage by ships (e.g., chemical coating and electrical heating cables buried in the walls).

MP 1065

ENGINEERING PROPERTIES OF SEA ICE.

Schwarz, J., et al, *Journal of glaciology,* 1977, 19(81), p.499-531, In English with French and German summaries. Refs. p.526-530. For this paper from another source see 31-2778.

Weeks, W.F.

32-2470

ICE SHELVES, ICE STRUCTURE, ICE MECHANICS, ICE FRICTION, ICE THERMAL PROPERTIES, ICE ELECTRICAL PROPERTIES, ICE (CONSTRUCTION MATERIAL), ENGINEERING, SEA ICE, ICE STRENGTH.

As the continental shelves of the Arctic become important as source areas for the oil and minerals required by human society, sea ice becomes an increasing challenge to engineers. The present paper starts with a consideration of the different fields of engineering which require information on sea ice with the tasks ranging from the design of ice-breaking ships to Arctic drilling platforms and man-made ice islands. Then the structure of sea ice is described as it influences the observed variations in physical properties. Next the status of our knowledge of the physical properties important to engineering is reviewed. Properties discussed include mechanical properties (compressive, tensile, shear and flexural strengths; dynamic and static elastic moduli; Poisson's ratio), friction and adhesion, thermal properties (specific and latent heats, thermal conductivity and diffusivity, density) and finally electromagnetic properties (dielectric permittivity and loss, resistivity). Particular attention is given to parameters such as temperature, strain-rate, brine volume, and loading direction as they affect property variations. Gaps, contradictions in the data, and inadequacies in testing techniques are pointed out. Finally suggestions are made for future research, especially for more basic laboratory studies designed to provide the data base upon which further theoretical developments as well as field studies can be built. (Auth.)

MP 1066

STUDIES OF THE MOVEMENT OF COASTAL SEA ICE NEAR PRUDHOE BAY, ALASKA, U.S.A.

Weeks, W.F., et al, *Journal of glaciology,* 1977, 19(81), p.533-546, In English with French and German summaries. 5 refs. For this paper from another source see 31-2777.

Kovacs, A., Mock, S.J., Tucker, W.B., Hibler, W.D., III, Gow, A.J.

32-2471

FAST ICE, PACK ICE, ICE MECHANICS, THERMAL EXPANSION, RADAR TRACKING, LASERS, SEA ICE, ICE CONDITIONS, UNITED STATES—ALASKA—PRUDHOE BAY.

During March-May 1976, a combination of laser and radar ranging systems was used to study the motion of both the fast ice and the pack ice near Narwahl and Cross Islands, two barrier islands located 16 and 21 km offshore in the vicinity of Prudhoe Bay, Alaska. Laser measurements of targets on the fast ice near Narwahl Island indicate small net displacements of approximately 1 m over the period of study (71 d) with short-term displacements of up to 40 cm occurring over 3 d periods. The main motion was outward normal to the coast and was believed to be the result of thermal expansion of the ice. The radar records of fast-ice sites farther offshore show a systematic increase in the standard deviation of the displacements as measured parallel to the coast, reaching a value of 6.6 m at 31 km. The farthest fast-ice sites show short-term displacements of up to 12 m. There are also trends in the records that are believed to be the result of the general warming of the fast ice with time. Radar targets located on the pack ice showed large short-term displacements (up to 2.7 km) but negligible net ice drift along the coast. There was no significant correlation between the movement of the pack and the local wind, suggesting that coastal ice prediction models can only succeed if handled as part of a regional model which incorporates stress transfer through the pack. The apparent fast-ice-pack-ice boundary in the study are was located in 30-35 m of water. (Auth.)

MP 1067

SHORT-TERM FORECASTING OF WATER RUN-OFF FROM SNOW AND ICE.

Colbeck, S.C., *Journal of glaciology,* 1977, 19(81), p.571-588, In English with French and German summaries. Refs. p.585-587.

32-2474

RUNOFF FORECASTING, SNOW HYDROLOGY, ICE MELTING, SNOW MELTING, GLACIAL HYDROLOGY, MELTWATER, SNOW COVER EFFECTS, MODELS.

Accurate forecasting of water run-off from snow covers and glaciers is increasingly important because of the increasing competition for scarce water resources. The trend toward conceptual computerized models of hydrologic systems requires extensive knowledge of the physical aspects of those systems. Unlike river and stream networks, the hydrological characteristics of snow covers and glaciers are highly variable with time and cannot be easily defined. After reviewing the physical aspects of water flow through snow covers and glaciers, it is concluded that snow covers and glaciers are predictable hydrological systems once the melt metamorphism of the snow is complete and the englacial conduits have been established. However, much additional information about snow and ice masses must be generated before general forecasting techniques can be established for all situations. (Auth.)

MP 1068

ROLE OF RESEARCH IN DEVELOPING SURFACE PROTECTION MEASURES FOR THE ARCTIC SLOPE OF ALASKA.

Johnson, P.R., Symposium on Surface Protection through Prevention of Damage (Surface Management). Focus: the Arctic Slope, Anchorage, Alaska, May 17-20, 1977. Proceedings. Edited by M.N. Evans. Anchorage, Alaska, Bureau of Land Management, Mar. 1978, p.202-205.

32-2648

ENVIRONMENTAL PROTECTION, SNOW ACCUMULATION, SNOW (CONSTRUCTION MATERIAL), ICE (CONSTRUCTION MATERIAL), CIVIL ENGINEERING, U.S. ARMY CRREL, RESEARCH PROJECTS, UNITED STATES—ALASKA—NORTH SLOPE.

The U.S. Army Cold Regions Research and Engineering Laboratory (USA CRREL) has long conducted research in snow, ice, and permafrost. It also translates foreign language engineering papers and publishes research reports, monographs, and bibliographies. Snow and ice roads and construction pads have been used, primarily on the Arctic Slope, during the last few winters. Some have been successful but problems exist which will require further experience and research to solve. One problem is that of snow supply. Snowfall on the Arctic Slope is limited, particularly early in the season when it is most desired. Few good data are available on total quantities and the time pattern of snowfall but Wyoming Snow Gages, now being installed by a number of government agencies and private organizations, are beginning to provide some data which can be used with some confidence. The snow which falls is often blown off by the strong winds which are common in the area so it is not available where it is needed. Research is under way on equipment and techniques for collecting snow and inducing drifting.

MP 1069

INTEGRATED APPROACH TO THE REMOTE SENSING OF FLOATING ICE.

Campbell, W.J., et al, International Astronautical Congress, 26th, Lisbon, September 21-27, 1975. Proceedings. Edited by L.G. Napolitano, Oxford, Pergamon Press, 1977, p.445-487, Refs. p.483-487.

Ramseier, R.O., Weeks, W.F., Gloersen, P.

32-2840

FLOATING ICE, REMOTE SENSING, SENSOR MAPPING, AERIAL RECONNAISSANCE, SEASONAL VARIATIONS.

The current increase of scientific interest in all forms of floating ice—sea ice, lake ice, river ice, ice shelves and icebergs—has occurred during a time of rapid evolution of both remote-sensing platforms and sensors. The application of these new research tools to ice studies in the Arctic and Antarctic has generally been both piecemeal and sporadic, partly because the community of ice scientists has not kept up with the rapid advances in remote sensing technology and partly because they have not made their needs known to the space community. This paper seeks to help remedy the latter shortcoming. The remote sensing requirements for floating ice studies are given, and the capabilities of various existing and future sensors and sensor combinations in meeting these requirements are discussed. The desirable future sensors are also discussed from both the research and operational points of view.

MP 1070

DYNAMICS OF SNOW AVALANCHES.

Mellor, M., Rockslides and avalanches, 1. Natural phenomena. Edited by B. Voight, New York, Elsevier, 1978, p.753-792, 22 refs.

32-2937

AVALANCHE MECHANICS, SNOW COVER STABILITY, SHEAR STRAIN, AVALANCHE WIND.

After a general introduction to snow avalanches and their consequences, type classification is discussed, and classification schemes are described briefly. The first technical section deals with deformation and displacement of snow slopes prior to avalanche release, with the failure process, and with the propagation of initial failure. The following section describes various types of avalanche motion after release. Representative values are suggested for slope angles, initial accelerations, flow density, driving stresses, and travel velocities. The third technical section considers idealized theoretical analyses of avalanche motion. The final technical section covers the dynamic forces imposed by snow avalanches and their associated "winds." Measured values of impact stresses are summarized, and direct impact stresses for "wide" avalanches are deduced from simple theory. Forces induced by interfacial shear and avalanche deflection are considered briefly, and forces created by avalanche winds, or "air blast," are discussed. In the conclusion there is a simplified tabulation of representative values for stress ranges, typical strain rates and typical velocities in the various avalanche processes.

MP 1071

IN-SITU MEASUREMENTS ON THE CONDUCTIVITY AND SURFACE IMPEDANCE OF SEA-ICE AT VLF FREQUENCIES.

McNeill, D., et al, *Copenhagen. Polyteknisk laereanstalt. Laboratoriet for elektromagnetisk feltteori. Report,* Dec. 1971, R105, 19p. plus diagrams, 9 refs. Also published in Radio science, Jan. 1973, 8(1):23-30.
Hoekstra, P.
27-700
SEA ICE, ICE RESISTIVITY, ELECTRICAL RESISTIVITY.

An experimental program to measure in-situ values of the electrical conductivity and surface impedance of sea ice at VLF frequencies was carried out at Pt. Barrow, Alaska. Temperature, salinity, and resistivity were measured as a function of depth in the ice for both first year and multiyear sea ice by means of cored samples. All three quantities varied with the age of the ice and, in addition, the resistivity varied with age from 100 to 10,000 ohm-meters at the surface, and in general down to a few ohm-meters at the sea water interface. The wave tilt of a VLF plane wave propagating over sea ice is theoretically linearly dependent on the thickness. Measurements of the quadrature phase wave tilt at 18.6 KHz give values of the right order of magnitude but erratic in local behavior. Short-spacing Wenner array resistivity measurements and telluric current measurements at VLF demonstrated that the erratic behavior was due to significant horizontal variations of the sea ice resistivity over distances of a few feet.

MP 1072

UV RADIATIONAL EFFECTS ON: MARTIAN REGOLITH WATER.

Nadeau, P.H., Hanover, New Hampshire, Dartmouth College, Aug. 1977, 89p., M.A. thesis. Refs. p.66-89.
32-2972
MARS (PLANET), SOIL CHEMISTRY, CHEMICAL REACTIONS, ENVIRONMENTS, HYDROGEN PEROXIDE, SOLAR RADIATION, ULTRAVIOLET RADIATION, ECOLOGY, ENVIRONMENT SIMULATION.

MP 1073

DYNAMICS OF NEAR-SHORE ICE.

Kovacs, A., et al, Environmental assessment of the Alaskan continental shelf. Vol.XVI. Hazards. Principal investigators' reports for the year ending March 1977. Boulder, Colorado, Environmental Research Laboratories, 1977, p.151-163.
Weeks, W.F.
32-3067
SEA ICE, DRIFT, ICE DEFORMATION, LASERS.

MP 1074

DELINEATION AND ENGINEERING CHARACTERISTICS OF PERMAFROST BENEATH THE BEAUFORT SEA.

Sellmann, P.V., et al, Environmental assessment of the Alaskan continental shelf. Vol.XVI. Hazards. Principal investigators' reports for the year ending March 1977. Boulder, Colorado, Environmental Research Laboratories, 1977, p.385-395.
Blouin, S.E., Brown, J., Chamberlain, E.J., Iskandar, I.K., Ueda, H.T.
32-3071
SUBSEA PERMAFROST, PERMAFROST PHYSICS, PERMAFROST DISTRIBUTION, ENGINEERING.

The overall objectives of the CRREL participation in the subsea permafrost program are to quantify the engineering characteristics and ascertain the distribution of permafrost beneath the Beaufort Sea and to determine their relationship to temperature, sediment type, ice content and chemical composition. Permafrost was present in the four holes drilled at Prudhoe Bay. Ice-bonded permafrost was absent in the upper 30 meters of sediment up to 17 kilometers from shore. Based on negative temperature gradients and pore water chemistry, ice-bonded permafrost should be encountered at 30- and 43-meter depths at sites PB-2 and PB-3, respectively. It appears that the depth to the ice-bonded permafrost decreases with increasing distance from shore and depth of water. Highly over-consolidated marine clays were encountered seaward of Reindeer Island. The overconsolidation probably resulted from the freeze-thaw history. The presence of these stiff, marine clay deposits is an important consideration for siting structures associated with offshore developments.

MP 1075

ROSS ICE SHELF PROJECT ENVIRONMENTAL IMPACT STATEMENT JULY, 1974.

Parker, B.C., et al, Environmental impact in Antarctica, edited by B.C. Parker, Blacksburg, Virginia Polytechnic Institute and State University, 1978, p.7-36, 13 refs.
McWhinnie, M.A., Elliott, D., Reed, S.C., Rutford, R.H.
32-3113
ENVIRONMENTAL IMPACT, ICE SHELVES, DRILLING, RESEARCH PROJECTS, ANTARCTICA—ROSS ICE SHELF.

The scientific objectives of the Ross Ice Shelf Project (RISP) are to drill into the ice shelf to investigate the physical, chemical, biological, and geological conditions in the ice shelf, the water mass beneath the ice, and the soft sediments and bedrock at the bottom of the sea, and to use the data obtained for interpretation of the present conditions and the history of this portion of Antarctica. This environmental impact assessment describes the proposed action, summarizes the scientific studies to be undertaken, and outlines remedial and protective measures, unavoidable adverse impacts, and alternatives to the proposed action. It is anticipated that the majority of the impacts will be short-term and extremely localized, such as those associated with the camp and laboratory facility on the Ross Ice Shelf during the period of drilling. These impacts will be monitored throughout the RISP operations. The pristine nature of the surface should be restored fully within one year. It is stressed that the likelihood of penetrating a hydrocarbon trap is remote, but should this occur rendering an uncontrollable release of hydrocarbons, the impact on the environment could be quite severe. On a scale of 1 to 10 this possibility is assigned a value of 5.

MP 1076

DYNAMICS OF NEAR-SHORE ICE.

Kovacs, A., et al, Environmental assessment of the Alaskan continental shelf. Vol.II. Principal investigators' quarterly reports for the period April-June 1977. Boulder, Colorado, Environmental Research Laboratories, 1977, p.411-424.
Weeks, W.F.
32-3188
SEA ICE, ICE MECHANICS, FAST ICE, ICE STRUCTURE.

MP 1077

DELINEATION AND ENGINEERING CHARACTERISTICS OF PERMAFROST BENEATH THE BEAUFORT SEA.

Sellmann, P.V., et al, Environmental assessment of the Alaskan continental shelf. Vol.II. Principal investigators' quarterly reports for the period April-June 1977. Boulder, Colorado, Environmental Research Laboratories, 1977, p.432-440.
Brown, J., Blouin, S.E., Chamberlain, E.J., Iskandar, I.K., Ueda, H.T.
32-3189
SUBSEA PERMAFROST, OFFSHORE DRILLING, ICE COVER THICKNESS, DRILL CORE ANALYSIS, CHEMICAL ANALYSIS.

MP 1078

GROUTING SILT AND SAND AT LOW TEMPERATURES.

Johnson, R., Conference on Applied Techniques for Cold Environments, Anchorage, Alaska, May 17-19, 1978. Proceedings, Vol.2, New York, American Society of Civil Engineers, 1979, p.937-950, 2 refs.
33-4452
GROUTING, VISCOSITY, SOIL STABILIZATION, FROZEN GROUND MECHANICS, SANDS, STRESS STRAIN DIAGRAMS, COMPRESSIVE STRENGTH, TEMPERATURE EFFECTS, COLD WEATHER OPERATION, RESINS, TESTS.

MP 1079

INTERHEMISPHERIC COMPARISON OF CHANGES IN THE COMPOSITION OF ATMOSPHERIC PRECIPITATION DURING THE LATE CENOZOIC ERA.

Cragin, J.H., et al, Polar oceans. Proceedings of the Polar Oceans Conference, Montreal, May 1974. Edited by M.J. Dunbar, Montreal, Arctic Institute of North America, 1977, p.617-631, 26 refs. Includes discussion.
Herron, M.M., Langway, C.C., Jr., Klouda, G.A.
32-3432
GLACIER ICE, ICE SHEETS, ICE COMPOSITION, PRECIPITATION (METEOROLOGY), DUST, ICE CORES.

Concentrations of alkali and alkaline earth elements in north Greenland glacial ice deposited during the past 100,000 years show marked variations over that time span. Prior to the Wisconsin Stage concentrations of Na, K, Mg and Ca average 26, 4.4, 6.3, and 18 microg/l respectively. Concentration levels rise gradually at the beginning of the Wisconsin Stage and peak at averages of 51, 29, 25, and 162 microg/l during the last third. During the Holocene the concentration levels decrease to lows of 17, 3.3, 2.6, and 5.1 microg/l. Silicon concentrations increase by about a factor of 3 (over Sangamon levels of 100 microg/l) during the late Wisconsin Stage, indicating a significant influx of eolian dust at that time. Although sulfate concentrations are high (280 microg/l) during the last third of the Wisconsin Stage, they remain relatively constant (100 microg/l) prior to and after that time; this might suggest that the Wisconsin Stage was not triggered by volcanism. Similar elemental concentrations measured in West Antarctic glacial ice deposited essentially over the same time period as the Greenland material also increase during the late Wisconsin Stage, but to a much smaller extent than those in Greenland ice. (Auth.)

MP 1080

EFFECT OF FREEZING AND THAWING ON THE PERMEABILITY AND STRUCTURE OF SOILS.

Chamberlain, E.J., et al, International Symposium on Ground Freezing, 1st, Bochum, Germany, March 8-10, 1978. Proceedings. Edited by H.L. Jessberger, Bochum, Ruhr University, 1978, p.31-44, 11 refs.
Gow, A.J.
32-3469
FREEZE THAW CYCLES, SOIL WATER MIGRATION, PERMEABILITY, SOIL STRUCTURE, SOIL PHYSICS, SOIL TEXTURE, FINES, PARTICLE SIZE DISTRIBUTION.

The permeability and structure of four fine-grained soils were observed to be changed by freezing and thawing. In all cases freezing and thawing caused a reduction in void ratio and an increase in vertical permeability. The increase in permeability is attributed to the formation of polygonal shrinkage cracks and/or to the reduction of the volume of fines in the pores of the coarse fraction, the mechanism controlling the process depending on material type. No definite relationships are established; however, it appears that the largest increase in permeability occurs for the soil of highest plasticity.

MP 1081

SEGREGATION FREEZING AS THE CAUSE OF SUCTION FORCE FOR ICE LENS FORMATION.

Takagi, S., International Symposium on Ground Freezing, 1st, Bochum, Germany, March 8-10, 1978. Proceedings. Edited by H.L. Jessberger, Bochum, Ruhr University, 1978, p.45-51, 20 refs.
32-3470
SOIL FREEZING, GROUND ICE, ICE LENSES, SOIL WATER MIGRATION, FROST HEAVE, FROZEN GROUND THERMODYNAMICS, SOIL STRUCTURE, SOIL PRESSURE, ANALYSIS (MATHEMATICS).

A new freezing mechanism, called segregation freezing, is proposed to explain the generation of the suction force that draws pore water up to the freezing surface of a growing ice lens. The segregation freezing temperature is derived by applying thermodynamics to a soil mechanics concept that distinguishes the mechanically effective pressure from the mechanically neutral pressure. The frost-heaving procedure is formulated as part of the solution of the differential equations of the simultaneous flow of heat and water, of which the segregation freezing temperature is one of the boundary conditions.

MP 1082

EFFECT OF FREEZE-THAW CYCLES ON RESILIENT PROPERTIES OF FINE-GRAINED SOILS.

Johnson, T.C., et al, U.S. Army Cold Regions Research and Engineering Laboratory, [1978], 19p., Prepared for International Symposium on Ground Freezing, Bochum, Germany, March 8-10, 1978. 20 refs.
Cole, D.M., Chamberlain, E.J.
32-3502
FROZEN GROUND MECHANICS, FREEZE THAW CYCLES, PAVEMENT BASES, BEARING TESTS, SHEAR STRESS, SUBGRADE SOILS, LOADS (FORCES), SOIL MOISTURE CONTENT, SOIL TEMPERATURE, MODELS.

Stress-deformation data for silt and clay subgrade soils were obtained from in-situ tests and laboratory tests, for use in mechanistic models for design of pavements that will experience freezing and thawing. Plate-bearing tests were run on in-service all-bituminous-concrete (ABC) pavements constructed directly on silt subgrade, and on an experimental ABC pavement constructed on clay subgrade, applying repeated loads to the pavement surfaces while the subgrade was frozen, thawing, thawed, and fully recovered. Analysis of deflection data from the in-situ tests showed resilient moduli of the subgrade soils up to more than 10 GPa when frozen, as low as 2 MPa during the thawing period, and up to more than 100 MPa when fully recovered. Analysis of the laboratory tests, which gave moduli comparable to the latter values, showed that resilient modulus and Poisson's ratio in the thawed and recovering conditions can be expressed as a function of the stress rate, the moisture content, and the dry density.

MP 1083

TEMPERATURE EFFECTS IN COMPACTING AN ASPHALT CONCRETE OVERLAY.

Eaton, R.A., et al, Conference on Applied Techniques for Cold Environments, Anchorage, Alaska, May 17-19, 1978. Proceedings, Vol.1, New York, American Society of Civil Engineers, 1978, p.146-158, 9 refs.
Berg, R.L.
32-3608
BITUMINOUS CONCRETES, COMPACTING, DENSITY (MASS/VOLUME), TEMPERATURE EFFECTS, COOLING RATE.

An asphalt concrete overlay was constructed at the U.S. Army Cold Regions Research and Engineering Laboratory

(CRREL), Hanover, New Hampshire, in November, 1976, to evaluate temperature and other environmental effects upon compaction. Four overlay sections each 100ft x 12 ft x 3 in. thick and two sections each 80 ft x 12 ft x 1-1/2 in. thick were designed to be placed on an existing CRREL test road. The asphalt cement and aggregate used were to have mix characteristics as close to the Thule mix as possible. This paper presents results of the test overlay using an AC 2.5 in a cold environment.

MP 1084
KOTZEBUE HOSPITAL—A CASE STUDY.

Crory, F.E., Conference on Applied Techniques for Cold Environments, Anchorage, Alaska, May 17-19, 1978. Proceedings, Vol.1, New York, American Society of Civil Engineers, 1978, p.342-359, 10 refs.

32-3624

BUILDINGS, SETTLEMENT (STRUCTURAL), PERMAFROST BENEATH STRUCTURES, FOUNDATIONS, SOIL TEMPERATURE.

Construction of the hospital was started in late 1959 and completed in September 1961. The hospital is a single-story structure, supported on insulated perimeter wall footings, with intermediate footings for the support of roof columns and grade beams. All floors are slab-on-grade concrete. Wall cracking was in evidence in the first year of occupancy. A void of more than a foot was found between the floor slab and the gravel fill in August, 1963. At the request of the U.S. Public Health Service, USA CRREL conducted soil explorations and installed ground temperature assemblies and vertical movement points within the building and around the *perimeter* of the foundation to ascertain the source and potential magnitude of the foundation distress. The performance of the hospital through 1976 clearly indicates the settlement associated with the thawing of the underlying permafrost with time. Soil and permafrost conditions in the village of Kotzebue are described in light of the conditions disclosed in the hospital area.

MP 1085
EFFECTS OF MOISTURE AND FREEZE-THAW ON RIGID THERMAL INSULATIONS: A LABORATORY INVESTIGATION.

Kaplar, C.W., Conference on Applied Techniques for Cold Environments, Anchorage, Alaska, May 17-19, 1978. Proceedings, Vol.1, New York, American Society of Civil Engineers, 1978, p.403-417, 13 refs.

32-3628

THERMAL INSULATION, ABSORPTIVITY, MOISTURE, FREEZE THAW TESTS.

Laboratory observations on the effects of moisture absorption and freeze-thaw on various thermal insulation boards commonly used in construction beneath slabs on grade, in roofs, and in perimeter insulation of foundations were made under wet conditions. Test specimens were submerged in water and buried in moist soil for periods ranging up to 36 months. Selected soaked specimens submerged in water were subjected to 15 and 30 freeze-thaw cycles. The study showed that: 1) None of the materials was completely resistant to moisture absorption under all test conditions; 2) A number of extruded polystyrenes were highly resistant to moisture; 3) The beaded polystyrene boards were more absorbent than the extruded types; and 4) Alternate freezing and thawing of rigid insulation in presence of free water was either destructive or increased moisture absorption in most of the tested materials; and 5) Cellular glass, normally highly moisture resistant in soaking tests, suffered extremely severe deterioration in freeze-thaw tests. This study clearly demonstrated that only highly moisture-resistant rigid thermal insulations should be used under conditions subject to free water and alternate freezing and thawing.

MP 1086
DESIGN CONSIDERATIONS FOR AIRFIELDS IN NPRA.

Crory, F.E., et al, Conference on Applied Techniques for Cold Environments, Anchorage, Alaska, May 17-19, 1978. Proceedings, Vol.1, New York, American Society of Civil Engineers, 1978, p.441-458, 6 refs.

Berg, R.L., Burns, C.D., Kachadoorian, R.

32-3631

AIRCRAFT LANDING AREAS, FROZEN SAND, FROZEN GRAVEL, PETROLEUM INDUSTRY.

Two exploratory wells, at Inidgok and Tunalik, will be spudded in the spring of 1978. The well sites require airfields for Hercules aircraft during the entire drilling operation. Design and construction problems for the two airfields are compounded by the constraint that they be built in winter and in accordance with environmental requirements which necessitate that all fill and gravel be transported over snow roads. Laboratory studies conducted at USACRREL showed that *fills of frozen silty sand, the only locally available* borrow at Inigok, have a greater potential for settlement upon thawing than the in-situ sands in cut sections. Several design options were considered for the airfields, drill pads and short connecting roads which must be usable all year. These included (1) gravel over sand, (2) gravel over insulation on sand, (3) landing mat with insulation, and (4) landing mat without insulation. Some of these concepts were evaluated at USAEWES, using large-scale test sections. In conjunction with the airfields, additional test sections are planned to evaluate different design concepts for runways, drill pads and roads to be built for the 1979 drilling program. This paper describes studies associated with the Inigok airfield.

MP 1087
EFFECTS OF SUBGRADE PREPARATION UPON FULL DEPTH PAVEMENT PERFORMANCE IN COLD REGIONS.

Eaton, R.A., Conference on Applied Techniques for Cold Environments, Anchorage, Alaska, May 17-19, 1978. Proceedings, Vol.1, New York, American Society of Civil Engineers, 1978, p.459-473, 8 refs.

32-3632

BITUMINOUS CONCRETES, COLD WEATHER PERFORMANCE, SUBGRADE PREPARATION, FROST HEAVE.

In September, 1973, a "full-depth" road test section was constructed at the U.S. Army Cold Regions Research and Engineering Laboratory (CRREL), Hanover, New Hampshire. Due to weather and time constraints, the subgrade beneath the asphalt concrete pavement was not properly prepared (blended, mixed, and made as uniform as possible). The road is in a cut area on an 8% slope and intersects horizontal layers of varved silts, silty sands, and sandy materials which are highly frost susceptible. The first winter, surface differential heaves of up to 5 inches in 5 feet occurred. The following summer, the subgrade was removed for 100 feet to a depth of 24 inches and 100 feet to a depth of 12 inches. The material was mixed, blended, and dried before placing back into the roadway in 6-inch compacted lifts. The succeeding two winters' performance has shown very marked improvement with relatively uniform heaving of the pavement surface. This shows, in conjunction with other CRREL highway pavement test sections, the importance of proper subgrade preparation for pavements in cold regions over frost-susceptible *soils.*

MP 1088
STORM DRAINAGE DESIGN CONSIDERATIONS IN COLD REGIONS.

Lobacz, E.F., et al, Conference on Applied Techniques for Cold Environments, Anchorage, Alaska, May 17-19, 1978. Proceedings, Vol.1, New York, American Society of Civil Engineers, 1978, p.474-489, 12 refs.

Eff, K.S.

32-3633

DRAINAGE, AIRCRAFT LANDING AREAS, ICE CONTROL, COLD WEATHER OPERATION.

This paper, based on the authors' recently revised design manual for drainage facilities at Army and Air Force airfields and heliports, adapts previously used U.S. hydraulic design criteria to the special conditions prevailing in arctic and subarctic regions. Design runoff supply rates for surface drainage are derived from rainfall plus snowmelt minus infiltration, three factors for which typical values are given, for both permafrost and unfrozen ground situations. Guidelines are discussed for other drainage design requirements such as structural, durability, maintenance, and, of major significance in cold regions, environmental impact considerations and debris and icing control. Because of the importance of control and prevention of icings in and near drainage structures, applicable principles formulated by CRREL and other researchers are enunciated. While primarily intended for design of storm drain pipes, appurtenances and open drainage ditches serving airfields and heliports, the principles outlined are also generally suitable for culverts and drainage for facilities such as roadways, parking lots, and built-up areas in the Arctic and Subarctic.

MP 1089
TECHNIQUES FOR USING MESL (MEMBRANE ENCAPSULATED SOIL LAYERS) IN ROADS AND AIRFIELDS IN COLD REGIONS.

Smith, N., Conference on Applied Techniques for Cold Environments, Anchorage, Alaska, May 17-19, 1978. Proceedings, Vol.1, New York, American Society of Civil Engineers, 1978, p.560-570, 19 refs.

32-3640

SOIL TEXTURE, SOIL WATER, SOIL COMPACTION, WATERPROOFING, LAYERS.

Membrane encapsulation of fine-grained soils to prevent soil moisture intrusion can provide an option to the use of more expensive select granular soils as structural layers in roads and airfields, even in cold regions. Silts and clays compacted at, or slightly below, optimum moisture contents can provide high bearing strengths and are not subject to moisture migration or detrimental frost heaving during closed system (membrane encapsulated) freezing. Central Alaska has an abundant supply of silts, and the semi-arid climate is ideal for air-drying those that have an in-situ moisture content above optimum. In other areas it might not be economically or technically feasible to dry the soils to the required moisture content for encapsulation unless granular soils are extremely scarce.

MP 1090
WATER RESOURCES BY SATELLITE.

McKim, H.L., *Military engineer,* May-June 1978, 70(455), p.164-169.

32-3654

REMOTE SENSING, SPACEBORNE PHOTOGRAPHY, WATER SUPPLY, SNOW COVER, ICE COVER, MAPPING.

MP 1091
MASS TRANSFER ALONG ICE SURFACES OBSERVED BY A GROOVE RELAXATION TECHNIQUE.

Tobin, T.M., et al, *International Association of Hydrological Sciences. Publication,* 1977, No.118, International Symposium on Isotopes and Impurities in Snow and Ice, Grenoble, Aug. 28-30, 1975, p.34-37, In English with French summary. 6 refs.

Itagaki, K.

32-3809

MASS TRANSFER, ARTIFICIAL ICE, DEUTERIUM OXIDE ICE, RELAXATION (MECHANICS).

The mass transfer coefficients were measured using a groove decay technique on the (0001) planes of naturally and artificially grown H2O ice and artificially grown D2O ice at -10C. In each case a viscous flow term contributed the most to groove decay in the longest wavelengths measured, while an evaporation-condensation term predominated in the shortest wavelengths measured. All other terms were found to be negligible. Large discrepancies between the decay constants obtained from measurements and the constants calculated from theory indicate that other mechanisms not considered in Mullins' theory may be responsible for the groove decay.

MP 1092
VANADIUM AND OTHER ELEMENTS IN GREENLAND ICE CORES.

Herron, M.M., et al, *International Association of Hydrological Sciences. Publication,* 1977, No.118, International Symposium on Isotopes and Impurities in Snow and Ice, Grenoble, Aug. 28-30, 1975, p.98-102, In English with French summary. 16 refs.

Langway, C.C., Jr., Weiss, H.V., Hurley, J.P., Kerr, R., Cragin, J.H.

32-3817

ICE COMPOSITION, CHEMICAL ANALYSIS, ICE CORES, GREENLAND.

Chemical analysis for Na, Cl, Al, Mn and V of surface snows and deeper ice core samples from station Milcent, Greenland, indicates a terrestrial or marine origin for these constituents. Pre-1900 enrichment factors, based on average crustal composition, are high for Zn and Hg and appear to be related to the volatility of these elements. A comparison of pre-1900 and 1971-1973 concentrations of V and *Hg shows no decided increase* due to industrial production, yet the relative abundance of Zn increased from 12 to 32 over this time period. The chemical composition of ancient ice is extremely useful in interpreting modern aerosols.

MP 1093
TRACER MOVEMENT THROUGH SNOW.

Colbeck, S.C., *International Association of Hydrological Sciences. Publication,* 1977, No.118, International Symposium on Isotopes and Impurities in Snow and Ice, Grenoble, Aug. 28-30, 1975, p.255-262, In English with French summary. 19 refs.

32-3840

SNOW COMPOSITION, MOISTURE TRANSFER, IMPURITIES.

Impurities flowing with water through snow undergo hydrodynamic dispersion. Solutions describing the distribution of impurities are hard to obtain for realistic boundary conditions. The movement of impurities in snow is approximated here by neglecting second-order effects on their movement.

MP 1094
SEASONAL VARIATIONS OF CHEMICAL CONSTITUENTS IN ANNUAL LAYERS OF GREENLAND DEEP ICE DEPOSITS.

Langway, C.C., Jr., et al, *International Association of Hydrological Sciences. Publication,* 1977, No.118, International Symposium on Isotopes and Impurities in Snow and Ice, Grenoble, Aug. 28-30, 1975, p.302-306, In English with French summary. 13 refs.

Klouda, G.A., Herron, M.M., Cragin, J.H.

32-3846

ICE CORES, CHEMICAL ANALYSIS, SEASONAL VARIATIONS, ICE DATING.

Chemical analysis of century-old ice from continuous 5-year intervals of three ice cores obtained from south and central Greenland (Dye 3, Milcent and Crête) shows maximum concentrations of Na, Mg, Ca, K and Al during early spring and minimum concentrations during late summer and early fall. Peak spring values are as much as 10 times greater than fall values. Because of the large seasonal chemical variations, samples used for depth-age or annual deposition rate studies must represent exactly one (or multiple) year's accumulation. The seasonal chemical variations seem promising as a new method of defining annual layers and thus dating old ice cores.

MP 1095

STABLE ISOTOPE PROFILE THROUGH THE ROSS ICE SHELF AT LITTLE AMERICA V, ANTARCTICA.

Dansgaard, W., et al, *International Association of Hydrological Sciences. Publication,* 1977, No.118, International Symposium on Isotopes and Impurities in Snow and Ice, Grenoble, Aug. 28-30, 1975, p.322-325, In English with French summary. 9 refs.

Johnsen, S.J., Clausen, H.B., Hammer, C.U., Langway, C.C., Jr.

32-3849

ICE SHELVES, ICE DATING, ICE COMPOSITION, ISOTOPE ANALYSIS, ANTARCTICA—ROSS ICE SHELF.

The delta (O-18)-profile along the Little America V ice core ranges from -20 per mille near the surface to -35 per mille at the bottom, i.e., lower than at any surface value hitherto measured in West Antarctica. (Auth.)

MP 1096

THERMAL PROPERTIES AND REGIME OF WET TUNDRA SOILS AT BARROW, ALASKA.

McGaw, R., et al, International Conference on Permafrost, 3rd, Edmonton, Alberta, Canada, July 10-13, 1978. Proceedings. Vol.1, Ottawa, National Research Council of Canada, 1978, p.47-53, With Russian and French summaries. 12 refs.

Outcalt, S.I., Ng, E.

32-3670

TUNDRA SOILS, THERMAL CONDUCTIVITY, TUNDRA VEGETATION, SOIL TEMPERATURE, TEMPERATURE MEASUREMENT.

Measurements of temperature and of thermal conductivity for two summer periods were carried out on wet organic surface materials and underlying mineral soils at Barrow, Alaska. Precise temperatures were measured by means of calibrated thermistors placed at accurately known depths, from which temperature gradients to a depth of 1.0 m are calculated. Thermal conductivities were measured by the transient-heating probe method, both in-situ and in the laboratory. The observed conductivity of the organic layer was between that of moist air (0.1 W/mK) and that of water (0.6 W/mK); the conductivity of the silt soil depended on the state of freezing. The measured data are combined to calculate summer heat fluxes to a depth of 1.0 m, from which the thermal transition of the active layer from initial thawing to incipient freezing is described and analyzed.

MP 1097

DETERMINATION OF UNFROZEN WATER IN FROZEN SOIL BY PULSED NUCLEAR MAGNETIC RESONANCE.

Tice, A.R., et al, International Conference on Permafrost, 3rd, Edmonton, Alberta, Canada, July 10-13, 1978. Proceedings. Vol.1, Ottawa, National Research Council of Canada, 1978, p.149-155, With Russian and French summaries. 12 refs.

Burrous, C.M., Anderson, D.M.

32-3685

FROZEN GROUND, GROUND ICE, UNFROZEN WATER CONTENT, MEASURING INSTRUMENTS.

Pulsed nuclear magnetic resonance (NMR) techniques have been developed and utilized to determine complete phase composition curves for three soils. This promising new technique offers a non-destructive method for measurements of unfrozen water contents in frozen soils from -0.2C through -25C. The results show that unfrozen water contents determined by this technique depend upon ice content (i.e. total water content). These results are contrary to earlier assumptions based on results which indicated that unfrozen water contents are a function of temperature only. These findings show great promise in the discrimination of unfrozen water associated with mineral grain boundaries and the ice-water interfaces of the poly-crystalline ices present in soil-water systems.

MP 1098

GEOECOLOGICAL MAPPING SCHEME FOR ALASKAN COASTAL TUNDRA.

Everett, K.R., et al, International Conference on Permafrost, 3rd, Edmonton, Alberta, Canada, July 10-13, 1978. Proceedings. Vol.1, Ottawa, National Research Council of Canada, 1978, p.359-365, With Russian and French summaries. 8 refs.

32-3717

TUNDRA, MAPPING, CHARTS, VEGETATION PATTERNS, TUNDRA SOILS, UNITED STATES—ALASKA.

A unified geoecological mapping system has been developed for northern Alaska which recognizes in a given area a suite of landforms whose geomorphic elements control the composition and distribution of vegetation and soil. Within each landform boundary a fractional code is displayed in which the numerator consists of the geomorphic feature and its characteristic vegetation stand presented as a series of alpha-numeric units. The denominator is comprised of three elements: the soil(s), the landform type and its mean slope. Each map contains an annotated list of code symbols and is accompanied by a text in which the characteristics of the code components are discussed. The advantages of such a mapping technique include: (1) integrating on a single base a large body of diverse data into a relatively few easily detected environment units; (2) the derivation of any number of special purpose maps by selecting components of the code and/or related analytical data; (3) permitting an expansion of the code to include other kinds of geotechnical or environmental data.

MP 1099

CLIMATIC AND DENDROCLIMATIC INDICES IN THE DISCONTINUOUS PERMAFROST ZONE OF THE CENTRAL ALASKAN UPLANDS.

Haugen, R.K., et al, International Conference on Permafrost, 3rd, Edmonton, Alberta, Canada, July 10-13, 1978. Proceedings. Vol.1, Ottawa, National Research Council of Canada, 1978, p.392-398, With Russian and French summaries. 17 refs.

Brown, J.

32-3722

PERMAFROST DISTRIBUTION, DISCONTINUOUS PERMAFROST, ALPINE TUNDRA, TUNDRA VEGETATION, FOREST TUNDRA, PLANT ECOLOGY, CLIMATIC FACTORS, UNITED STATES—ALASKA—CENTRAL ALASKAN UPLANDS.

Most climatic records from central Alaska represent lowland sites. Consequently, continuous climatic observations were initiated in 1970 at four sites (750-1150 m elevation) 160 km north of Fairbanks near Eagle Summit, at one site (760 m) to km east of Livengood, and at one site (1040 m) on the northern flank of Mt. Fairplay. Mean annual temperatures at these upland sites range from -8.1 to -6.4C, as compared to -3.5C at Fairbanks for the same period of record. The site data characterize air temperatures and permafrost conditions for several different alpine tundra and forested settings. Based upon correlations of radial growth of timberline white spruce and June-July temperatures, dendroclimatic patterns of warm and cool growing seasons are documented over the past 300 years for the Yukon-Tanana Uplands. Similar timberline tree growth patterns are found south to the Alaska Range and at the white spruce timberline in the southern foothills of the Brooks Range, suggesting a relative uniformity of summer temperature patterns throughout central Alaska.

MP 1100

BIOLOGICAL RESTORATION STRATEGIES IN RELATION TO NUTRIENTS AT A SUBARCTIC SITE IN FAIRBANKS, ALASKA.

Johnson, L.A., International Conference on Permafrost, 3rd, Edmonton, Alberta, Canada, July 10-13, 1978. Proceedings. Vol.1, Ottawa, National Research Council of Canada, 1978, p.460-466, With Russian and French summaries. 9 refs.

32-3732

SUBARCTIC LANDSCAPES, ARCTIC LANDSCAPES, ENVIRONMENTAL PROTECTION, REVEGETATION, UNITED STATES—ALASKA—FAIRBANKS.

Restoration needs in the far north have dramatically increased as the extent of surface disturbance has increased over the last decade. The urgency of arctic and subarctic revegetation and restoration has prompted the use of technology developed in the temperate zones, at least some of which may ultimately be suitable in these colder regions. A randomized block design was established in 1975 on the Chena Flood Control Project in order to test the effect of nutrient applications upon the competitive relationships between arctared fescue, bluejoint reedgrass, and annual rye. Data gathered over two growing seasons on biomass, cover, maximum height, nutrient content, and other pertinent parameters are used to predict the effects of nutrient manipulation upon long-term restoration goals. It is anticipated that this research will increase the options available for successful mitigation of impact from northern industrial development.

MP 1101

SHALLOW ELECTROMAGNETIC GEOPHYSI- CAL INVESTIGATIONS OF PERMAFROST.

Arcone, S.A., et al, International Conference on Permafrost, 3rd, Edmonton, Alberta, Canada, July 10-13, 1978. Proceedings. Vol.1, Ottawa, National Research Council of Canada, 1978, p.501-507, With Russian and French summaries. 6 refs.

Sellmann, P.V., Delaney, A.J.

32-3738

PERMAFROST PHYSICS, ELECTRICAL PROPERTIES, ELECTRICAL PROSPECTING, PERMAFROST DISTRIBUTION, MEASURING INSTRUMENTS.

Radiowave surface impedance (SI) and LF (200-400 kHz) and VLF (10-30 kHz) and magnetic induction (MI) methods were used to investigate permafrost properties and distribution in the Fairbanks and Copper River Basin areas of Alaska. Recently developed portable field instruments were used. The sites contained a range of materials and ground ice of varying volume and type. Galvanic resistivity soundings and existing borehole data provided ground truth for data comparison. Local plane wave interpretations of the LF and VLF apparent resistivity and phase data correlated with subsurface conditions. Frequencies in the LF band were most sensitive to permafrost conditions at the sites studied while VLF frequencies were more affected by conductive materials underlying the permafrost. The MI technique also correlated with subsurface control, but the coil spacing used limited the instrument's depth of penetration, making it more sensitive to variations in the active layer than the other instruments.

MP 1102

THAW PENETRATION AND PERMAFROST CONDITIONS ASSOCIATED WITH THE LIVENGOOD TO PRUDHOE BAY ROAD, ALASKA.

Berg, R.L., et al, International Conference on Permafrost, 3rd, Edmonton, Alberta, Canada, July 10-13, 1978. Proceedings. Vol.1, Ottawa, National Research Council of Canada, 1978, p.615-621, With Russian and French summaries. 16 refs.

Brown, J., Haugen, R.K.

32-3754

ROADS, PERMAFROST BENEATH ROADS, ACTIVE LAYER, HEAT TRANSFER, GROUND THAWING, CONTINUOUS PERMAFROST, DISCONTINUOUS PERMAFROST, THERMAL REGIME, UNITED STATES—ALASKA—PRUDHOE BAY.

An environmental engineering study including the 88 kilometer *TAPS Road and the 580 kilometer Alyeska Pipeline Haul* Road was initiated during the summer of 1976. Physiography along the route ranges from the rolling Yukon-Tanana Uplands, where the permafrost is warm (-1 C) and discontinuous, through the Brooks Range and the Arctic Foothills to the Arctic Coastal Plain, where permafrost is cold (-10 C) and continuous. Permanently frozen subgrade materials range from rock to extremely ice-rich fine-grained silts. Approximately 30 sites have been selected for measuring thaw subsidence and seasonal thaw penetration; instrumentation for measuring air temperatures has been installed at 15 sites and surface temperatures were also measured at three of these sites. The 1976 thawing indexes varied from 350C degree-days at Prudhoe Bay to 1880C degree-days at Livengood. Measured thaw penetration in undisturbed areas adjacent to the road varied from 28 cm to 112 cm. The calculated gravel embankment thickness to prevent subgrade thawing during the 1976 thawing season ranged from 1.9 m near Prudhoe Bay to 5.2 m near Livengood.

MP 1103

DENSIFICATION BY FREEZING AND THAWING OF FINE MATERIAL DREDGED FROM WATERWAYS.

Chamberlain, E.J., et al, International Conference on Permafrost, 3rd, Edmonton, Alberta, Canada, July 10-13, 1978. Proceedings. Vol.1, Ottawa, National Research Council of Canada, 1978, p.622-628, With Russian and French summaries. 11 refs.

Blouin, S.E.

32-3755

FINES, DREDGING, SOIL COMPACTION, FREEZE THAW CYCLES.

Volume changes and permeabilities for fine material dredged from waterways were observed in the laboratory after full consolidation and freeze-thaw cycling for applied pressures in the range of 0.93 to 30.73 kN/sq m. Up to 20% volume reduction was observed when dredged materials with liquid limits in the range of 60 to 90% were subjected to freeze-thaw cycling. Vertical permeabilities were observed to increase by as much as two orders of magnitude. The technical and economic feasibility of using freeze-thaw overconsolidation procedures to increase the volume of material stored in disposal sites is considered.

MP 1104

ENGINEERING PROPERTIES OF SUBSEA PERMAFROST IN THE PRUDHOE BAY REGION OF THE BEAUFORT SEA.

Chamberlain, E.J., et al, International Conference on Permafrost, 3rd, Edmonton, Alberta, Canada, July 10-13, 1978. Proceedings. Vol.1, Ottawa, National Research Council of Canada, 1978, p.629-635, With Russian and French summaries. 14 refs.

Sellmann, P.V., Blouin, S.E.

32-3756

SUBSEA PERMAFROST, DRILLING, DRILL CORE ANALYSIS, FROZEN ROCK TEMPERATURE, BEAUFORT SEA.

Core samples, cone penetration resistance and temperature data obtained from subsea sediments near Prudhoe Bay, Alaska, provided the basis for this study. The sites were located 1 to 17 km from shore in 2 to 12 m of water. Maximum hole depth was 50 m. The materials at the drill sites included sands and gravels overlain by 4.5 to 7.5 m of silts and clays. No ice-bonded materials were observed, although thermal data indicated that permafrost was present. Index property, triaxial compressive strength, consolidation and permeability data were obtained in the laboratory. Strengths ranged between 25 and 270 kPa for the fine material. Highly overconsolidated clays were encountered at the site farthest from shore. The preconsolidation pressure was estimated to be 1.5 MPa. Based on considerations of geologic and climatic history, it is proposed that the overconsolidation is a result of freezing and thawing

MP 1105

STRENGTH AND DEFORMATION OF FROZEN SILT.

Haynes, F.D., International Conference on Permafrost, 3rd, Edmonton, Alberta, Canada, July 10-13, 1978. Proceedings. Vol.1, Ottawa, National Research Council of Canada, 1978, p.655-661, With Russian and French summaries. 20 refs.

32-3760

FROZEN FINES, TENSILE STRENGTH, COMPRESSIVE STRENGTH, FROZEN GROUND TEMPERATURE, DEFORMATION.

Results are given for tests made in uniaxial tension and uniaxial compression on frozen Fairbanks silt. These constant displacement rate tests were made over a strain rate range from .00016/s to 2.9/s and a temperature range from 0C to -57C. Over these ranges athe compressive strength increased about one order of magnitude, while the tensile strength doubled over the strain rate range and increased about one order of magnitude over the temperature range. For increasing strain rate and decreasing temperature, the specific energy for the compression tests and the modulus increased; but the specific energy for the tension tests decreased. Expressions were developed for the strength as a function of strain rate and temperature. The increase in strength with higher strain rates and lower temperatures is explained by the strength of the ice matrix, changes in the unfrozen water content, and intergranular friction.

MP 1106

INFLUENCE OF FREEZING AND THAWING ON THE RESILIENT PROPERTIES OF A SILT SOIL BENEATH AN ASPHALT PAVEMENT.

Johnson, T.C., et al, International Conference on Permafrost, 3rd, Edmonton, Alberta, Canada, July 10-13, 1978. Proceedings. Vol.1, Ottawa, National Research Council of Canada, 1978, p.662-668, With Russian and French summaries. 9 refs.

Cole, D.M., Chamberlain, E.J.

32-3761

FROZEN FINES, FREEZE THAW CYCLES, ROADS, PAVEMENTS, STRESS STRAIN DIAGRAMS, MODELS.

Stress-deformation data for silt subgrade soil were obtained from in-situ tests and laboratory tests, for use in mechanistic models for design of pavements affected by frost action. Plate-bearing tests were run on bituminous concrete pavements constructed directly on a silt subgrade, applying repeated loads to the pavement surface while the silt was frozen, thawing, thawed, and fully recovered. Repeated-load laboratory triaxial tests were performed on the silt in the same conditions. Analysis of deflection data from the in-situ tests showed resiliant moduli of the silt as low as 2000 kPa for the critical thawing period, and 100,000 kPa or higher when fully recovered. Analysis of the laboratory tests, which gave moduli comparable to the latter values, showed that resilient modulus during recovery from the thaw-weakened condition can be modeled as a function of the changing moisture content.

MP 1107

SOME EXPERIENCES WITH TUNNEL ENTRANCES IN PERMAFROST.

Linell, K.A., et al, International Conference on Permafrost, 3rd, Edmonton, Alberta, Canada, July 10-13, 1978. Proceedings. Vol.1, Ottawa, National Research Council of Canada, 1978, p.813-819, With Russian and French summaries. 9 refs.

Lobacz, E.F.

32-3783

TUNNELS, PERMAFROST CONTROL, COOLING SYSTEMS.

Tunnels and shafts in permafrost encounter special portal problems because of instability of surface materials during thaw, tendency for ice formation within the tunnel from annual thaw zone seepage, and necessity for control of air temperatures within the tunnel during summer. In constructing a tunnel in permafrost at Fox, Alaska, these problems were successfully solved. The unstable ground slope at the tunnel entrance was stabilized by use of a blanket of clean natural gravel. Refrigerant pipes imbedded in the backfill above the portals were used with a mechanical refrigeration system to insure a frozen zone around the tunnel where seepage would otherwise enter in summer. An insulated bulkhead containing doors permitted exclusion of warm summer air. Entrance to a vertical shaft connecting to the rear of the tunnel was kept shaded in order to minimize seepage entrance in summer.

MP 1108

CONSTRUCTION ON PERMAFROST AT LONGYEARBYEN ON SPITSBERGEN.

Tobiasson, W., International Conference on Permafrost, 3rd, Edmonton, Alberta, Canada, July 10-13, 1978. Proceedings. Vol.1, Ottawa, National Research Council of Canada, 1978, p.884-890, With Russian and French summaries. 6 refs.

32-3794

ROADS, FLOOD CONTROL, BUILDINGS, PERMAFROST BENEATH ROADS, FOUNDATIONS, PAD FOUNDATIONS, PERMAFROST DEGRADATION.

Facilities at Longyearbyen were designed and are being operated with an appreciation for the importance of preserving permafrost. Portions of the network of gravel roads and paved runway were constructed on ice-rich permafrost. Ditches, culverts and bridges have been sized to accommodate large peak flows since flash floods have occurred. Some difficulties have been experienced with progressive degradation of permafrost by surface and groundwater. Damming a low area and pumping out brackish water has created a year-round water supply lake. The post and pad foundation concept used extensively has proved quite successful. The hangar is an impressive use of an elevated floor above permafrost. Older buildings have been stabilized by adding slag insulation above supporting soils and installing open skirting below the first floor. Water lines and other utilities are supported on timber bents anchored in permafrost.

MP 1109

DETAILS BEHIND A TYPICAL ALASKAN PILE FOUNDATION.

Tobiasson, W., et al, International Conference on Permafrost, 3rd, Edmonton, Alberta, Canada, July 10-13, 1978. Proceedings. Vol.1, Ottawa, National Research Council of Canada, 1978, p.891-897, With Russian and French summaries. 7 refs.

Johnson, P.

32-3795

BUILDINGS, FOUNDATIONS, PERMAFROST BENEATH STRUCTURES.

When a warehouse at Barter Island burned down, a replacement was urgently needed. The new foundation consists of forty-five steel pipe piles, .25 m in diameter, set in 4.6 to 5.8 m deep holes made with a .46 m diameter auger. The annulus was backfilled with a sand-water slurry. Slurry freezeback was closely monitored using thermocouples. As freezeback was rapid, the contractor was allowed to set steel beams on a pile five days after it was installed and pour concrete ten days after the last pile was set. Groundwater problems during July required casing of augered holes with .51 m diameter pipe to a depth of 1 m. Mechanical difficulties and lack of a crane slowed pile installation, but contractor resourcefulness got the job done. Subsequent elevation surveys and thermocouple measurements indicate that the foundation is solidly frozen and stable.

MP 1110

LAND APPLICATION OF WASTEWATER IN PERMAFROST AREAS.

Sletten, R.S., International Conference on Permafrost, 3rd, Edmonton, Alberta, Canada, July 10-13, 1978. Proceedings. Vol.1, Ottawa, National Research Council of Canada, 1978, p.911-917, With Russian and French summaries. 14 refs.

32-3798

WASTES, WASTE TREATMENT, WATER TREATMENT, IRRIGATION.

Land application of wastewater can serve as a high performance treatment system, as a final disposal step for treated effluents, and as a polishing step for partially treated effluents. Experimental studies conducted near Fairbanks, Alaska, during 1974-76 investigated both high (5.5 to 152 meters/year) and low rate (0.6 to 5.5 m/yr) systems for the purpose of polishing aerated lagoon effluent to meet secondary treatment criteria. Results from the slow rate system indicate that drinking water quality can be achieved. However, even though nitrogen removal is not as great, the high rate (rapid infiltration) system is considered to be more feasible for cold climate conditions because the need for winter storage is less, the system does not rely on vegetative uptake, and the free-draining, coarse-textured soils necessary for such systems can be found in alluvial valleys and coastal areas where many Arctic communities are located. For most wastewater constituents, high rate systems are capable of sustained, effective performance in extreme climates.

MP 1111

RADAR ANISOTROPY OF SEA ICE DUE TO PREFERRED AZIMUTHAL ORIENTATION OF THE HORIZONTAL C-AXES OF ICE CRYSTALS.

Kovacs, A., et al, *Arctic Ice Dynamics Joint Experiment. AIDJEX bulletin,* Mar. 1978, No.38, p.171-201, 32 refs.

Morey, R.M.

32-3878

ICE CRYSTAL STRUCTURE, SEA ICE, OCEAN CURRENTS, RADAR ECHOES, ANISOTROPY.

Results of impulse radar, ice crystal c-axis and sub-ice current measurements on the fast-ice near Narwhal Island, Alaska, are presented. The crystal structure of the ice was found to have a horizontal crystal c-axis with a preferred azimuthal orientation. This orientation was found to align with the direction of the current at the ice water interface. Impulse radar reflection measurements revealed that the preferred orientation of the sea ice crystal structure behaved as a microwave polarizer. It was observed that when the antenna E-field was oriented parallel with the c-axis of the crystal platelets a strong reflection of the radar signal from the bottom of the ice was obtained. However, when the antenna E-field was oriented perpendicular to the c-axis, no bottom reflection was detected. The results of this study fully support earlier reports of sea ice in-homogeneity and anisotropy in reference to both structure and electromagnetic energy transmission.

MP 1112

LAND TREATMENT MODULE OF THE CAP-DET PROGRAM.

Merry, C.J., et al, Symposium on Military Applications of Environmental Research and Engineering, 8th, Dec. 7-8, 1977. Edgewood, Maryland, 1977, 4p.

Spaine, P.A.

32-3941

WASTE TREATMENT, WATER TREATMENT, COMPUTER PROGRAMS.

MP 1113

PRELIMINARY ANALYSIS OF WATER EQUIVALENT/SNOW CHARACTERISTICS USING LANDSAT DIGITAL PROCESSING TECHNIQUES.

Merry, C.J., et al, Eastern Snow Conference, Feb. 3-4, 1977, Belleville, Ontario, Canada. Proceedings, 1977, 16 leaves, 20 refs.

McKim, H.L., Cooper, S., Ungar, S.G.

32-3942

REMOTE SENSING, DATA PROCESSING, SNOW WATER EQUIVALENT, SNOW DEPTH.

The primary emphases of this analysis were to evaluate the accuracy of mapping the areal extent of snow and to determine the relationship between the water equivalent of the snowpack and the radiance obtained from the LANDSAT digital data. The test area selected for this task was the Dickey-Lincoln School Lakes Project located above the confluence of the St. John and Allagash Rivers in northern Maine. The computer algorithm utilized in this study uses two features—"color" and "albedo"— of the LANDSAT digital data to classify the multispectral data into land and water categories. Three snow courses (Allagash B, Beech Ridge and Ninemile B) yielding snow depth and water equivalent data were located. This task was accomplished using computer-generated gray scale printouts (scale 1:24,000) and topographic maps. The preliminary results indicated that the snow radiance values remained approximately the same for a similar water equivalent value of 9.5 inches. Extrapolation of these radiance values for the entire watershed can be used to map the areal extent of snow cover/vegetation with a water equivalent value of 9.5 inches which enables computation of potential water runoff.

MP 1114

USE OF THE LANDSAT DATA COLLECTION SYSTEM AND IMAGERY IN RESERVOIR MANAGEMENT AND OPERATION.

Cooper, S., et al, Waltham, Massachusetts, U.S. Army Corps of Engineers, 1977, c150p., Numerous refs.

Buckelew, T.D., McKim, H.L., Merry, C.J.

32-3943

WATERSHEDS, REMOTE SENSING, SPACEBORNE PHOTOGRAPHY, COMPUTER APPLICATIONS, SNOW WATER EQUIVALENT.

The New England Division Corps of Engineers demonstrated the use of the data collection and imagery systems in watershed management. A surplus antenna pedestal was refurbished and interfaced with a computer to provide an automatic ground receiver station which operated nearly continuously for over 18 months. Adequate reliability for operational use was proven, and daily procedures were compressed to one half hour of operator time per day. Comparisons of costs and operation constraints were drawn among Landsat DCS, GOES DCS, and groud-based radio. Computer compatible tapes of Landsat imagery were analyzed to evaluate the mapping accuracy of the area of snow to determine a relationship between the water equivalent of a snowpack and the radiance recorded in Landsat digital data, and to delineate wetlands and flood areas in New England. Sensor interfaces were developed and evaluated for the collection of real time environmental data via the Landsat DCS.

MP 1115

ECOLOGICAL BASELINE INVESTIGATIONS ALONG THE YUKON RIVER-PRUDHOE BAY HAUL ROAD, ALASKA.

Brown, J., ed, Hanover, New Hampshire, U.S. Army Cold Regions Research and Engineering Laboratory, 1978, 131p., Progress report to the Department of Energy. For individual reports see 32-3889 through 32-3896.

32-3888

ROADS, ENVIRONMENTS, VEGETATION, PLANTS (BOTANY), MAPPING.

MP 1116

DISTRIBUTION AND PROPERTIES OF ROAD DUST AND ITS POTENTIAL IMPACT ON TUNDRA ALONG THE NORTHERN PORTION OF THE YUKON RIVER-PRUDHOE BAY HAUL ROAD. CHEMICAL COMPOSITION OF DUST AND VEGETATION.

Iskandar, I.K., et al, Ecological baseline investigations along the Yukon River-Prudhoe Bay Haul Road, Alaska, edited by J. Brown. MP 1115, Hanover, New Hampshire, U.S. Army Cold Regions Research and Engineering Laboratory, 1978, p.110-111, 2 refs.

Quarry, S.T., Brown, J.

32-3896

ROADS, DUST, TUNDRA VEGETATION, CHEMICAL ANALYSIS, ION DENSITY (CONCENTRATION).

MP 1117

OBTAINING FRESH WATER FROM ICEBERGS.

Mellor, M., *Akademiia nauk SSSR. Institut geografii. Materialy gliatsiologicheskikh issledovanii. Khronika obsuzhdeniia,* 1977, Vol.31, p.193, In Russian.

32-3932

WATER SUPPLY, ICEBERGS, ECONOMIC ANALYSIS.

Conclusions of two conferences on the towing and utilization of icebergs, one held in Paris in June, 1977, the other at the University of Iowa in Oct., 1977, are reviewed. There is keen interest in water supply from icebergs, but technical problems remain. Rough estimates indicate that obtaining water from icebergs may be economically useful for rich countries with a fresh-water shortage.

MP 1118

SOME CHARACTERISTICS OF GROUNDED FLOEBERGS NEAR PRUDHOE BAY, ALASKA.

Kovacs, A., et al, *Arctic,* Sep. 1976, 29(3), p.169-172, 10 refs. For another version of this paper see 32-1083.

Gow, A.J.

32-1082

SEA ICE, SOUNDING, ICE BOTTOM SURFACE, ACOUSTIC MEASURING INSTRUMENTS, ICE STRUCTURE, PRESSURE RIDGES.

MP 1119

ARCTIC AND SUBARCTIC ENVIRONMENTAL ANALYSIS.

Anderson, D.M., et al, *Army research and development,* Dec. 1972, 13(8), p.28-30.

Haugen, R.K., Gatto, L.W., Slaughter, C.W., McKim, H.L., Marlar, T.L.

27-2043

REMOTE SENSING, TERRAIN IDENTIFICATION, ERTS IMAGERY.

The authors indicate that data from the Earth Resources Technology Satellite, ERTS-1, will provide greater opportunity to study relationships between snow pack and river ice, surface circulation and coastal sedimentation processes, and permafrost-vegetative relationships. An example of ERTS-1 imagery of a 115 square mile area 250 miles NW of Fairbanks, Alaska is shown with detailed identification of 59 cloud and terrain features.

MP 1120

MESOSCALE DEFORMATION OF SEA ICE FROM SATELLITE IMAGERY.

Anderson, D.M., et al, *U.S. National Aeronautics and Space Administration. Contractor report,* Oct. 25, 1973, NASA-CR-135741, 2p., N73-33307.

Crowder, W.K., McKim, H.L., Hibler, W.D., III.

29-141

SEA ICE, ICE MECHANICS, REMOTE SENSING, ERTS IMAGERY.

MP 1121

ICE AND SNOW AT HIGH ALTITUDES.

Mellor, M., Symposium on High Altitude Geoecology, Denver, Colorado, Feb. 20-25, 1977. American Association for the Advancement of Science, 1977, 10p.

32-4179

SNOW PHYSICS, SNOW MECHANICS, ICE PHYSICS.

MP 1122

OPPORTUNITIES FOR PERMAFROST-RELATED RESEARCH ASSOCIATED WITH THE TRANS-ALASKA PIPELINE SYSTEM.

National Research Council. Polar Research Board. Committee on Permafrost, Washington, D.C., National Academy of Sciences, 1975, 37p., Report of Workshop, March 19-22, 1975, Scottsdale, Arizona.

32-4221

MEETINGS, RESEARCH PROJECTS, PERMAFROST, PIPELINES.

MP 1123

EFFECTS OF HOVERCRAFT, WHEELED AND TRACKED VEHICLE TRAFFIC ON TUNDRA.

Abele, G., *National Research Council, Canada. Associate Committee on Geotechnical Research. Technical memorandum,* Mar. 1976, No.116, Muskeg Research Conference, 16th, Oct. 7, 1976. Proceedings, p.186-215, 16 refs.

31-1510

AIR CUSHION VEHICLES, TRACKED VEHICLES, VEHICLE WHEELS, TUNDRA VEGETATION, DAMAGE.

In support of the Advanced Research Projects Agency (ARPA) Arctic Surface Effects Vehicle (ASEV) Program, traffic tests were conducted during the summer of 1971 near Barrow, Alaska, on various types of tundra terrains using an SK-5 Air Cushion Vehicle. The main objectives of the study were to investigate the effects of air cushion vehicle operations and traffic on tundra, specifically, the extent and pattern of erosion, the degree of damage, initial and permanent, to the vegetation, the subsequent effect on the soil thermal regime due to any surface disturbance by the ACV, and to compare the general ecological impact of ACV traffic with that of other ground vehicles.

MP 1124

DIFFICULTIES OF MEASURING THE WATER SATURATION AND POROSITY OF SNOW.

Colbeck, S.C., *Journal of glaciology,* 1978, 20(82), p.189-201, 26 refs.

32-4457

WET SNOW, SNOW WATER CONTENT, POROSITY, SATURATION, MEASURING INSTRUMENTS, ACCURACY, REMOTE SENSING.

Liquid saturation and porosity control most of the important material properties of wet snow, hence accurate measurements of these two parameters are of the utmost importance for both field research and glaciological applications. Nevertheless, most of the instruments in use are not capable of making accurate determinations of saturation. An error analysis shows that only direct measurements of the liquid volume can provide accurate values of water saturation, hence the melting calorimeter is inherently inaccurate. While centrifuges extract some of the liquid for direct measurement, there is always some residual liquid left, depending on the grain size and structural parameters of the ice matrix. Therefore, some uncertainty exists over the interpretation of the data obtained from centrifuges. High-frequency capacitance probes can be used either *in situ* or on the surface and are very sensitive to the volume of liquid present. Capacitance probes are by far the best of the available devices.

MP 1125

1977 TUNDRA FIRE IN THE KOKOLIK RIVER AREA OF ALASKA.

Hall, D.K., et al, *Arctic,* Mar. 1978, 31(1), p.54-58, ADA-062 439, 10 refs.

Brown, J., Johnson, L.A.

32-4577

TUNDRA VEGETATION, REMOTE SENSING, SPACEBORNE PHOTOGRAPHY, THAW DEPTH, FIRES.

The authors describe a lightning-set fire on the north coast of Alaska southwest of Barrow in July-August, 1977. Ground and satellite observations were made to determine the effects of the fire on the tundra vegetation and the thaw depth of the permafrost. The study indicates that natural drainages form effective fire breaks in the region and that fire intensity is related to vegetation type and the moisture present in the soil.

MP 1126

RADAR PROFILE OF A MULTI-YEAR PRESSURE RIDGE FRAGMENT.

Kovacs, A., *Arctic,* Mar. 1978, 31(1), p.59-62, 9 refs.

32-4578

SEA ICE, PRESSURE RIDGES, RADAR ECHOES, ICE COVER THICKNESS.

The usefulness of radar profiling pressure ridges of multi-year ice is described. Radar echoes provide thickness measurements of ridge keels and sails and help to define the most difficult of all Arctic obstacles. The author warns, however, that the radar technique is still in its infancy and all but excludes profiling the thickness of first-year ice pressure ridges.

MP 1127

EFFECT OF TEMPERATURE AND STRAIN RATE ON THE STRENGTH OF POLYCRYSTALLINE ICE.

Haynes, F.D., *National Research Council, Canada. Associate Committee on Geotechnical Research. Technical memorandum,* Oct. 1977, No.121, p.107-111, 8 refs.

32-4701

ICE CRYSTALS, ICE STRENGTH, TEMPERATURE EFFECTS, STRAIN TESTS, SNOW ICE.

The focus of this paper is on the results of laboratory tests on polycrystalline, isotropic snow ice. Test temperatures ranged from 0C to -56C, and strain rates ranged from 0.001/sec to 0.1/sec. Tests in both uniaxial compression and uniaxial tension were made on dumbbell-shaped specimens.

MP 1128

ICEBERG THICKNESS AND CRACK DETECTION.

Kovacs, A., International Conference and Workshops on Iceberg Utilization for Fresh Water Production, Weather Modification, and Other Applications, 1st, Iowa State University, Ames, October 2-6, 1977. Proceedings. Edited by A.A. Husseiny, New York, Pergamon Press, 1978, p.131-145, 18 refs.

32-4718

ICEBERGS, ICE COVER THICKNESS, RADAR ECHOES, ICE ISLANDS, CREVASSES, ICE CRACKS, ANTARCTICA—MCMURDO SOUND.

Results obtained with an impulse radar system used to profile the thickness of and detect cracks in a tabular iceberg in McMurdo Sound, Antarctica, and an ice island in the Beaufort Sea near Flaxman Island, Alaska, are presented. Graphic records are shown of the radar impulse travel time which clearly reveal, for the first time, the bottom relief of each ice formation. Also detected in the antarctic iceberg was an echo signature from an infiltration-brine layer. The impulse radar signature of a 3-m wide crevasse in the McMurdo Ice Shelf is also shown. The time of flight of the radar impulse in the ice island is compared with a 24.05-m drill hole measurement of the ice thickness. The effective velocity of the radar impulse in the ice island was found to be 0.16m/ns and the effective dielectric constant of the ice to be 3.5. The findings show that tabular icebergs are flawed by cracks or crevasses which could be expected to propagate through the ice when an iceberg reaches the edge of the pack where it is subject to stresses induced by sea swell and waves. (Auth.)

MP 1129

CATALOG OF SNOW RESEARCH PROJECTS.

Hanover, N.H., U.S. Army Cold Regions Research and Engineering Laboratory, Oct. 1975, 103p.

Dumont, N., ed.

33-66

SNOW SURVEYS, RESEARCH PROJECTS.

MP 1130

SHALLOW SNOW PERFORMANCE OF WHEELED VEHICLES.

Harrison, W.L., International Conference of the International Society for Terrain-Vehicle Systems, 5th, Detroit, Mich., June 2-6, 1975, Proceedings. Vol.2, Hoboken, N.J., [1976], p.589-614, 14 refs.

33-440

SNOW COMPRESSION, TRACTION, LOADS (FORCES), SNOW MECHANICS, RUBBER SNOW FRICTION, SNOW COMPACTION, ANALYSIS (MATHEMATICS), VEHICLES.

MP 1131

MATHEMATICAL MODEL TO PREDICT FROST HEAVE.

Berg, R.L., et al, International Symposium on Frost Action in Soils, Luleå, Sweden, Feb. 1977. Proceedings, Vol.2, University of Luleå, 1977, p.92-109, 14 refs.

Gartner, K.E., Guymon, G.L.

33-345

MATHEMATICAL MODELS, SOIL WATER MIGRATION, HEAT TRANSFER, FROST HEAVE, FROST PENETRATION.

A mathematical model of coupled heat and moisture flow in soils has been developed. The model includes algorithms for phase change of soil moisture and frost heave, and several types of boundary and initial conditions are permitted. The finite element method of weighted residuals (Galerkin procedure) was chosen to simulate the spatial regime and the Crank-Nicolson method was used for the time domain portion of the model. Comparison of simulated and experimental data illustrates the importance of unsaturated hydraulic conductivity. It is one parameter which is difficult to measure and for which only a few laboratory test results are available. Therefore, unsaturated hydraulic conductivities calculated in the computer model may be a significant source of error in calculations of frost heave.

MP 1132

SEA ICE PRESSURE RIDGES IN THE BEAUFORT SEA.

Wright, B.D., et al, IAHR Symposium on Ice Problems, Luleå, Sweden, Aug. 7-9, 1978. Proceedings, Part 1, International Association for Hydraulic Research, 1978, p.249-271, 10 refs.

Hnatiuk, J., Kovacs, A.

33-375

SEA ICE, PRESSURE RIDGES, ICE MODELS.

The ice cover in the Beaufort Sea is characterized by extreme irregularities in thickness which are produced by the motion and resulting deformation of the sea ice. Pressure ridges, which are an integral part of this irregular and formidable ice cover, are recognized as the largest and most hazardous ice formations. Here, a number of cross-sectional profiles of first and multi-year pressure ridges in the Beaufort Sea are presented, which include both free-floating and grounded ice forms. The cross-sections of these multi-year ridges suggest that they can be adequately described by one ridge model with a constant sail to keel ratio and geometry. It is shown that the ice comprising multi-year ridges is solid, with the interblock voids existing at the time of their formation being completely filled with ice. Several first-year pressure ridge profiles are also discussed, which indicate that these ridges cannot be represented by any one geometric model as their sail to keel ratios and geometries are quite variable.

MP 1133
ICE AND NAVIGATION RELATED SEDIMENTATION.

Wuebben, J.L., et al, IAHR Symposium on Ice Problems, Luleå, Sweden, Aug. 7-9, 1978. Proceedings, Part 1, International Association for Hydraulic Research, 1978, p.393-403, 5 refs.
Alger, G.R., Hodek, R.J.
33-383
ICE COVER EFFECT, ICE NAVIGATION, SEDIMENT TRANSPORT.

This paper examines the hydrodynamics of vessel passage through a restricted channel and the resulting potential for sediment translocation. Examples of field measurements are presented which show a complex pattern of changes in water current magnitude and direction. The constriction of the channel by a ship creates a drop in the water surface that travels with the ship. The application of the concepts of effective stress and upward seepage forces to the river-bed material predicts that the potential for sediment translocation increases upon the passage of this moving trough. Three modes of granular bottom sediment transport were observed: bed load, saltation, and a process referred to as explosive liquefaction.

MP 1134
ARCHING OF MODEL ICE FLOES AT BRIDGE PIERS.

Calkins, D.J., IAHR Symposium on Ice Problems, Luleå, Sweden, Aug. 7-9, 1978. Proceedings, Part 1, International Association for Hydraulic Research, 1978, p.495-507, 7 refs.
33-391
RIVER ICE, ICE FLOES, BRIDGES, PIERS, ICE PRESSURE, ICE MODELS, ICE DEFORMATION.

A model study of the formation of ice arching at the upstream faces of rounded bridge piers was conducted in a hydraulic flume. Polyethylene plastic was used to simulate square ice floes of two sizes, 37 mm and 74 mm. A power function relating the upstream surface ice concentration to a size ratio (characteristic block size over pier span opening) distinguishes between the arching and non-arching conditions at velocities below the critical value for underturning of individual ice floes.

MP 1135
FRAZIL ICE FORMATION IN TURBULENT FLOW.

Müller, A., et al, IAHR Symposium on Ice Problems, Luleå, Sweden, Aug. 7-9, 1978. Proceedings, Part 2, International Association for Hydraulic Research, 1978, p.219-234, 9 refs.
Calkins, D.J.
33-409
FRAZIL ICE, ICE FORMATION, TURBULENT FLOW, SUPERCOOLED WATER, ICE NUCLEI.

To study ice nucleation and heat transfer, frazil ice was produced experimentally under controlled conditions. Turbulence was generated by a moving grid in a turbulence jar, where water could be cooled below the freezing point. Frazil was observed by means of a schlieren system and the number of ice particles was counted on photographs. No frazil ice formed, regardless of turbulence and foreign material, unless the water was seeded with ice nuclei. The number of particles grew during the experiment; the growth rate increased with greater supercooling and higher velocity of the grid. This indicates a multiplication process induced by secondary nucleation. The heat transfer per particle normalized with supercooling, and the size of the particles was constant in all experiments within the accuracy of measurement. From these observations, it can be concluded that the total ice production is predictable if the heat transfer per particle can be estimated from turbulence data and if the number of particles can be calculated. A nucleation theory is, however, not available and is regarded as the crucial question.

MP 1136
RIGHTING MOMENT IN A RECTANGULAR ICE BOOM TIMBER OR PONTOON.

Perham, R.E., IAHR Symposium on Ice Problems, Luleå, Sweden, Aug. 7-9, 1978. Proceedings, Part 2, International Association for Hydraulic Research, 1978, p.273-289, 5 refs.
33-413
ICE BOOMS, FLOATING STRUCTURES.

The ability of an ice boom timber to restrain ice floes is governed by its capacity to float and to resist being overturned. Six mathematical equations that describe this capacity for a rectangular-shaped timber have been worked out and are presented here. The limits of each equation are also given. They are called righting moment equations, and from them dimensionless values of righting moment may be calculated. The equations have been evaluated for some general conditions, and for a few specific cases involving water and wood, and for one case concerned with designing a steel pontoon boom. The calculations were done by a computer program which is not included. The data provided include three graphs and two tables of dimensionless values. All in all, the information should be very useful in evaluating new designs of ice boom timbers and pontoons.

MP 1137
ENTRAINMENT OF ICE FLOES INTO A SUBMERGED OUTLET.

Stewart, D.M., et al, IAHR Symposium on Ice Problems, Luleå, Sweden, Aug. 7-9, 1978. Proceedings, Part 2, International Association for Hydraulic Research, 1978, p.291-299, 2 refs.
Ashton, G.D.
33-414
FLOATING ICE, WATER INTAKES, WATER FLOW.

Results of a series of laboratory experiments in a flume to determine the conditions under which floating ice floes are entrained into a submerged outlet are reported. Entrainment is found to occur when a Froude number based on outlet velocity and submergence depth is exceeded and that critical Froude number is a function of the ratio of outlet height to upstream flow depth. The critical Froude number is also shown to asymptotically approach the Froude number corresponding to equilibrium accumulation thicknesses of ice floes at a surface obstruction as the outlet height approaches the flow depth. Interpretation and application to design of submerged outlets is discussed.

MP 1138
ICE ARCHING AND THE DRIFT OF PACK ICE THROUGH CHANNELS.

Sodhi, D.S., et al, IAHR Symposium on Ice Problems, Luleå, Sweden, Aug. 7-9, 1978. Proceedings, Part 2, International Association for Hydraulic Research, 1978, p.415-432, 25 refs.
Weeks, W.F.
33-423
SEA ICE, DRIFT, WIND VELOCITY, CHANNELS (WATERWAYS), ICE MODELS.

Models originally developed to describe the arching and the movement of granular materials through hoppers or chutes are applied to arching and drift of pack ice in straits and gulfs having lengths of 50 to 500 km. Verification of the usefulness of the models is attempted by making comparisons with ice deformation patterns as observed via satellite imagery in the Bering Strait region and in Amundsen Gulf. The results are encouraging in that there is good correspondence between observed arching and lead patterns and those predicted by theory. In addition, values determined via the model for the angle of internal friction and the cohesive strength per unit thickness are similar to values obtained by other approaches. It is estimated that if the wind velocity parallel to the Bering Strait exceeds 6 m/s, there will be ice flow through the strait. A one-dimensional formulation is presented, governing the ice pressure in a straight channel when the ice is stationary due to an ice arch or a boom.

MP 1139
RADAR ANISOTROPY OF SEA ICE DUE TO PREFERRED AZIMUTHAL ORIENTATION OF HORIZONTAL *C* AXES OF ICE CRYSTALS.

Kovacs, A., et al, *Journal of geophysical research,* Dec. 20, 1978, 83(C12), p.6037-6046, 36 refs.
Morey, R.M.
33-2286
SEA ICE, RADAR ECHOES, ANISOTROPY, ICE CRYSTAL STRUCTURE, ELECTROMAGNETIC PROPERTIES, OCEAN CURRENTS.

Results of impulse radar, ice crystal *c* axis, and subice current measurements on the fast ice near Narwhal Island, Alaska, are presented. The crystal structure of the ice was found to have a horizontal crystal *c* axis with a preferred azimuthal orientation. This orientation was found to align with the direction of the current at the ice-water interface. Impulse radar reflection measurements revealed that the preferred orientation of the sea ice crystal structure behaved as a microwave polarizer. It was observed that when the antenna *E* field was oriented parallel with the *c* axis of the crystal platelets, a strong reflection of the radar signal from the bottom of the ice was obtained. However, when the antenna *E* field was oriented perpendicular to the *c* axis, no bottom reflection was detected. The results of this study fully support earlier reports of sea ice inhomogeneity and anisotropy in reference to both structure and electromagnetic energy transmission.

MP 1140
REPORT OF PANEL ON TESTING IN ICE.

Frankenstein, G.E., et al, International Tank Towing Conference, 15th, The Hague, September 1978. Proceedings—Part 1, M.W.C. Oosterveld, editor, Wageningen, Netherlands Ship Model Basin, 1978, p.157-179, 34 refs.
33-543
MEETINGS, ICE NAVIGATION, ICE CONDITIONS, ICE MECHANICS, IMPACT TESTS, MECHANICAL TESTS, PLASTICITY TESTS.

MP 1141
ICE RELEASING BLOCK-COPOLYMER COATINGS.

Jellinek, H.H.G., et al, *Colloid and polymer sciences,* 1978, Vol.256, p.544-551, In English with German summary. 7 refs.
Kachi, H., Kittaka, S., Lee, M., Yokota, R.
33-545
PROTECTIVE COATINGS, POLYMERS, ICE REMOVAL, CHEMICAL ICE PREVENTION.

MP 1142
UPDATE ON SNOW LOAD RESEARCH AT CRREL.

Tobiasson, W., et al, *Eastern Snow Conference. Proceedings,* 1977, 34th, p.9-13, 20 refs.
Redfield, R.
33-624
SNOW LOADS, RESEARCH PROJECTS, SNOW DENSITY.

MP 1143
METHODOLOGY USED IN GENERATION OF SNOW LOAD CASE HISTORIES.

McLaughlin, D., et al, *Eastern Snow Conference. Proceedings,* 1977, 34th, p.163-174.
Duggan, G.
33-631
SNOW LOADS, ROOFS, DATA PROCESSING.

MP 1144
EFFECT OF WASTE WATER REUSE IN COLD REGIONS ON LAND TREATMENT SYSTEMS.

Iskandar, I.K., *Journal of environmental quality,* July-Sep. 1978, 7(3), p.361-368, 26 refs.
33-557
WATER TREATMENT, WASTE DISPOSAL, COLD WEATHER TESTS, SOIL CHEMISTRY.

The effect on ground water quality and soils and vegetation of treatment and disposal of municipal/industrial waste water on land in cold regions was investigated using six outdoor test cells. Winter application of waste water was feasible even at very cold air temperatures (<0.0C) at the New Hampshire test site. High NO3-N concentrations were observed in all treatments (5-15cm/week) in both soils in early summer. This was explained as leaching of NH4-H stored over the winter months after its oxidation to NO3 in early spring. The principal mechanism for nitrogen removal was found to be plant uptake, which was seasonally dependent. Application of 15 cm of secondary effluent per week to a sandy loam soil was not feasible because of the presence of >10mg/liter NO3-N in the leachate for >9 mo/year. Application of salts for road deicing during winter resulted in relatively higher concentrations of salts and Cl in the ground for a short period of time.

MP 1145
STATE OF KNOWLEDGE ON LAND TREATMENT OF WASTEWATER.

International Symposium on the State of Knowledge in Land Treatment of Wastewater, Aug. 20-25, 1978, Hanover, New Hampshire, Hanover, U.S. Army Cold Regions Research and Engineering Laboratory, 1978, 2 vols., For selected papers see 33-651 through 33-661.
33-650
MEETINGS, WASTE TREATMENT, WATER TREATMENT, AGRICULTURE, FOREST LAND, MATHEMATICAL MODELS, LAND DEVELOPMENT.

The objectives of this Symposium are to summarize the state of knowledge of the practical aspects of the treatment of wastewater by land application and to identify the suitable approaches for the design of such land treatment systems. The topics included are: site selection considerations, case studies of national and international concern, health effects of land treatment systems, pretreatment considerations, uses of wastewaters in agricultural and forest systems, monitoring, modeling and design criteria. The Proceedings are published in two volumes. Volume 1 contains the invited papers presented and discussed at the conference. Volume 2 contains shorter papers about on-going research that were selected from the responses received following a call for abstracts.

MP 1146
USE OF REMOTE SENSING TECHNIQUES AND OTHER INFORMATION SOURCES IN REGIONAL SITE SELECTION OF POTENTIAL LAND TREATMENT AREAS.

Merry, C.J., International Symposium on the State of Knowledge in Land Treatment of Wastewater, Aug. 20-25, 1978, Hanover, New Hampshire. Proceedings, Vol.1, Hanover, U.S. Army Cold Regions Research and Engineering Laboratory, 1978, p.107-119, 27 refs.
33-651
SITE SURVEYS, WATER TREATMENT, WASTE TREATMENT, REMOTE SENSING, SPACEBORNE PHOTOGRAPHY.

Landsat, Skylab S190A Multispectral Photographic Camera, and Skylab S190B Earth Terrain Camera satellite data products, enlarged to scales of 1:500,000 and 1:250,000, were used to prepare land use maps for regional site selection of potential land treatment areas. Interpretation of tonal and textural characteristics on the photography corresponded to vegetation, urban and agricultural land use categories. Color and color infrared transparencies augmented the land use mapping, which was accomplished on black and white photographic prints. The three systems are compared in terms of areal coverage, resolution, and time of product preparation.

MP 1147

EVALUATION OF THE MOVING BOUNDARY THEORY IN DARCY'S FLOW THROUGH POROUS MEDIA.

Nakano, Y., International Symposium on the State of Knowledge in Land Treatment of Wastewater, Aug. 20-25, 1978, Hanover, New Hampshire. Proceedings, Vol.1, Hanover, U.S. Army Cold Regions Research and Engineering Laboratory, 1978, p.142-151, 22 refs.

33-652

BOUNDARY VALUE PROBLEMS, SOIL WATER MIGRATION, POROUS MATERIALS, ANALYSIS (MATHEMATICS), THEORIES.

Traditionally in hydrology and soil physics, neither the water table nor the wetting front in Darcy's flow were believed to be singular surfaces. Recently, a new and conflicting theory has been advanced, using two different approaches. It has been shown, based upon continuum physics, that across both the water table and the wetting front local acceleration generally suffers a non-zero jump, and these two boundaries can be interpreted as acceleration waves. This interpretation was found consistent with reported regularity results obtained from a purely mathematical viewpoint.

MP 1148

EVALUATION OF N MODELS FOR PREDICTION OF NO3-N IN PERCOLATE WATER IN LAND TREATMENT.

Iskandar, I.K., et al, International Symposium on the State of Knowledge in Land Treatment of Wastewater, Aug. 20-25, 1978, Hanover, New Hampshire. Proceedings, Vol.1, Hanover, U.S. Army Cold Regions Research and Engineering Laboratory, 1978, p.163-169, 51 refs.

Selim, H.M.

33-653

WATER TREATMENT, SOIL CHEMISTRY, SEEPAGE, MATHEMATICAL MODELS.

Nitrogen simulation models developed to describe one or more processes in agricultural soils can be adopted for land treatment. The most important processes in the simulation of N transformations for prediction of N in percolate water in land treatment are: nitrification, denitrification, plant uptake and exchange of NH4 with the soil. The N model must be incorporated into a moisture flow model. It was concluded that the Michaelis-Menten type model is the most appropriate, although the first order kinetic may be used to describe the nitrification process. Modeling the denitrification process in slow infiltration must include biodegradable carbon and dissolved oxygen as limiting factors. Although several large models are available to simulate and predict N in leachate in land treatment, a need for a simplified model that can be tested in the field is apparent.

MP 1149

NITROGEN BEHAVIOR IN LAND TREATMENT OF WASTEWATER: A SIMPLIFIED MODEL.

Selim, H.M., et al, International Symposium on the State of Knowledge in Land Treatment of Wastewater, Aug. 20-25, 1978, Hanover, New Hampshire. Proceedings, Vol.1, Hanover, U.S. Army Cold Regions Research and Engineering Laboratory, 1978, p.171-179, 15 refs.

Iskandar, I.K.

33-654

WASTE TREATMENT, WATER TREATMENT, SOIL CHEMISTRY, SEEPAGE, MATHEMATICAL MODELS.

A simplified mathematical model was developed to describe transformations and transport of nitrogen under transient soil water flow conditions. Kinetic reactions were assumed to govern the nitrification and denitrification processes. A macroscopic approach was used to incorporate plant uptake of water as well as NO3-N and NH4-N from the soil solution. The sensitivity of the model to changes in rate of N transformation, N uptake by plants, and schedule and amounts of N application were also investigated. The model can be used as a tool to predict the fate of nitrogen in land treatment systems. The model is flexible and can be adapted to incorporate various nitrogen transformation mechanisms as well as layerings in the soil profile.

MP 1150

OVERVIEW OF EXISTING LAND TREATMENT SYSTEMS.

Iskandar, I.K., International Symposium on the State of Knowledge in Land Treatment of Wastewater, Aug. 20-25, 1978, Hanover, New Hampshire. Proceedings, Vol.1, Hanover, U.S. Army Cold Regions Research and Engineering Laboratory, 1978, p.193-200, 34 refs.

33-655

WASTE TREATMENT, WATER TREATMENT, SOIL CHEMISTRY, HISTORY.

This paper reviews existing systems of land application of wastewater. Particular emphasis is placed upon the historical philosophy of the utilization of the natural soil-plant system for purifying wastewater, reasons for the success or failure of the older systems, and experience gained from their design, construction and operation.

MP 1151

UPTAKE OF NUTRIENTS BY PLANTS IRRIGATED WITH MUNICIPAL WASTEWATER EFFLUENT.

Clapp, C.E., et al, International Symposium on the State of Knowledge in Land Treatment of Wastewater, Aug. 20-25, 1978, Hanover, New Hampshire. Proceedings, Vol.1, Hanover, U.S. Army Cold Regions Research and Engineering Laboratory, 1978, p.395-404, 21 refs.

Palazzo, A.J., Larson, W.E., Marten, G.C., Linden, D.R.

33-656

NUTRIENT CYCLE, IRRIGATION, WASTES, WATER TREATMENT, SOIL CHEMISTRY.

We present comparisons of plant nutrient uptake by corn and forage grasses when these crops were irrigated with secondary municipal wastewater effluent or treated with inorganic fertilizer. Characteristic analyses of effluent from various locations are given for the macro plant nutrients as well as for quality indicators. The importance of the presence of varying amounts of N, P, and K in effluent studies is discussed. Micro elements in effluent are considered for their use to meet nutrient requirements of these crops as well as for their potential for environmental contamination.

MP 1152

PERFORMANCE OF OVERLAND FLOW LAND TREATMENT IN COLD CLIMATES.

Jenkins, T.F., et al, International Symposium on the State of Knowledge in Land Treatment of Wastewater, Aug. 20-25, 1978, Hanover, New Hampshire. Proceedings, Vol.2, Hanover, U.S. Army Cold Regions Research and Engineering Laboratory, 1978, p.61-70, 15 refs.

Martel, C.J., Gaskin, D.A., Fisk, D.J., McKim, H.L.

33-657

WATER TREATMENT, WASTE TREATMENT, SOIL CHEMISTRY, COLD WEATHER PERFORMANCE.

The objective of this study was to evaluate the performance of overland flow systems, especially during the winter months. Operation of the CRREL overland flow facility began in May 1977 and continued through the winter of 1977-78. The results of this study indicated that satisfactory BOD removal did not occur at soil temperatures below 4C. Based on this criterion, 105 days of storage would be needed at the CRREL site. This is 30 days less than the storage needs predicted by the EPA-1 computer program

MP 1153

GROWTH AND NUTRIENT UPTAKE OF FORAGE GRASSES WHEN RECEIVING VARIOUS APPLICATION RATES OF WASTEWATER.

Palazzo, A.J., et al, International Symposium on the State of Knowledge in Land Treatment of Wastewater, Aug. 20-25, 1978, Hanover, New Hampshire. Proceedings, Vol.2, Hanover, U.S. Army Cold Regions Research and Engineering Laboratory, 1978, p.157-163, 10 refs.

McKim, H.L.

33-658

NUTRIENT CYCLE, SOIL CHEMISTRY, WASTE TREATMENT, GRASSES.

This study reports on the growth and nutrient removal of forage grasses receiving three years of wastewater applications. The forages received wastewater at various application rates and schedules and were grown in either a Windsor sandy loam or a Charlton silt loam soil. Plant and soil analyses were performed on representative samples during the study

MP 1154

MICROBIOLOGICAL AEROSOLS FROM A FIELD SOURCE DURING SPRINKLER IRRIGATION WITH WASTEWATER.

Bausum, H.T., et al, International Symposium on the State of Knowledge in Land Treatment of Wastewater, Aug. 20-25, 1978, Hanover, New Hampshire. Proceedings, Vol.2, Hanover, U.S. Army Cold Regions Research and Engineering Laboratory, 1978, p.273-280, 14 refs.

Brockett, B.E., Schumacher, P.W., Schaub, S.A., McKim, H.L., Bates, R.E.

33-659

WASTE TREATMENT, WATER TREATMENT, IRRIGATION, AEROSOLS.

Measurements were made of the strength and dispersion of bacterial aerosols resulting from land application of chlorinated, ponded wastewater by spray irrigation. An approximately square 2.1 hectare area was covered by 96 impact sprinklers, thus creating a multi-point or field aerosol source. Viable-type and large volume electrostatic precipitator air samplers were deployed upwind and on 3 m centers in each of three downwind transects. In four runs, water to be sprayed was seeded with fluorescent dye to characterize the aerosol cloud without the effect of biological decay. During aerosol studies, continuous on-site meteorological measurements were made, and wastewater chemical parameters were monitored

MP 1155

COMPUTER PROCEDURE FOR COMPARISON OF LAND TREATMENT AND CONVENTIONAL TREATMENT: PRELIMINARY DESIGNS, COST ANALYSIS AND EFFLUENT QUALITY PREDICTIONS.

Spaine, P.A., et al, International Symposium on the State of Knowledge in Land Treatment of Wastewater, Aug. 20-25, 1978, Hanover, New Hampshire. Proceedings, Vol.2, Hanover, U.S. Army Cold Regions Research and Engineering Laboratory, 1978, p.335-340, 4 refs.

Merry, C.J.

33-660

WASTE TREATMENT, WATER TREATMENT, COMPUTER PROGRAMS.

During 1972 a manual for the design of wastewater treatment facilities was developed by the U.S. Army Engineer Waterways Experiment Station. To complement the design manual and assist the field design engineer, the computer model CAPDET (Computer Assisted Procedure for the Design and Evaluation of Wastewater Treatment Systems) was developed. In response to field users' request, a land treatment module was developed and implemented into CAPDET. The CAPDET program provides planning level design and cost evaluations for any wastewater treatment system.

MP 1156

SIMULATION OF THE MOVEMENT OF CONSERVATIVE CHEMICALS IN SOIL SOLUTION.

Nakano, Y., et al, International Symposium on the State of Knowledge in Land Treatment of Wastewater, Aug. 20-25, 1978, Hanover, New Hampshire. Proceedings, Vol.2, Hanover, U.S. Army Cold Regions Research and Engineering Laboratory, 1978, p.371-380, 14 refs.

Iskandar, I.K.

33-661

SOIL WATER MIGRATION, SOIL CHEMISTRY, MATHEMATICAL MODELS.

A numerical method is introduced to simulate the movement of conservative chemicals in soil by water. The method is essentially based upon a finite element aproximation to the equation of continuity, and each element constitutes a complete mixing cell. The number of cells represents a degree of mixing. The theoretical justification of the method is presented and the accuracy of the method is examined, using experimental data obtained from a large lysimeter. It is found that the method can simulate the general trend of the movement of chemicals reasonably well, but fails to simulate the high frequency of variations that occur near the soil surface.

MP 1157

TECHNIQUE FOR MEASURING RADIAL DEFORMATION DURING REPEATED LOAD TRIAXIAL TESTING.

Cole, D.M., *Canadian geotechnical journal,* Aug. 1978, 15(3), p.426-429, In English with French summary. 3 refs.

33-638

ELECTRICAL MEASUREMENT, DYNAMIC LOADS, DEFORMATION.

A system of non-contacting displacement transducers has been used to record radial deformation in repeated load triaxial tests. Operating principle, system capabilities, and installation technique are discussed. Results of tests on clay and silt subgrade materials are presented and Poisson's ratio is calculated directly from test data.

MP 1158
REPETITIVE LOADING TESTS ON MEMBRANE ENVELOPED ROAD SECTIONS DURING FREEZE-THAW CYCLES.
Smith, N., et al, *American Society of Civil Engineers. Geotechnical Engineering Division. Journal,* Oct. 1978, 104(GT10), p.1277-1288, 15 refs. For other versions of this paper see 32-562 (MP 962) and/or 32-4407 (CR 78-12, ADA-056 744).
Eaton, R.A., Stubstad, J.
33-645
FREEZE THAW TESTS, ROADS, SUBGRADE PREPARATION, PROTECTIVE COATINGS, DYNAMIC LOADS.

Road test sections of impermeable membrane-enveloped silt and clay soils overlain with asphalt cement concrete were subjected to repetitive dynamic plate-bearing loadings to determine strength variations of the pavement systems during freeze-thaw cycles. The modulus values of the asphalt cement concrete vary inversely with its temperature by an order of magnitude in the temperature range of 110F to 30F. The resilient stiffness of the pavement system varied in the same manner by nearly a factor of eight. Despite the wide strength variations of the sections during freeze-thaw cycles, membrane enveloped fine-grained soils can be utilized instead of granular materials as base and subbase layers in flexible pavements in cold regions where moisture migration is a major concern. Without the membrane protection such fine-grained soils that experience frost heaving suffer severe bearing strength loss during thawing.

MP 1159
PHYSICAL MEASUREMENTS OF RIVER ICE JAMS.
Calkins, D.J., *Water resources research,* Aug. 1978, 14(4), p.693-695, 5 refs.
33-641
RIVER ICE, ICE JAMS, MEASUREMENT, ICE COVER THICKNESS.

River ice jam measurements have always been relatively difficult to obtain because of the uncertain stability of the floating ice mass. But recently two ice jams resolidified for about 3 weeks, allowing the ice thickness to be measured at several cross sections along their longitudinal profiles. The size distribution of surface ice floes in one of the jams was also evaluated from low-level aerial photography. The ice jams were found to be thickest at the downstream end, of the order of 4-5 times the thickness of the ice cover before breakup, and decreased almost linearly in thickness upstream. The largest surface ice floes measured in one ice jam ranged from 0.27 to 0.05 of the river's average width (45m). The largest floes were at the downstream end, and floe size decreased progressively with distance upstream.

MP 1160
COMPUTER SIMULATION OF BUBBLER-INDUCED MELTING OF ICE COVERS USING EXPERIMENTAL HEAT TRANSFER RESULTS.
Keribar, R., et al, *Canadian journal of civil engineering,* Sep. 1978, 5(3), p.362-366, In English with French summary. 9 refs.
Tankin, R.S., Ashton, G.D.
33-1243
ICE MELTING, ARTIFICIAL MELTING, BUBBLING, COMPUTERIZED SIMULATION.

Results of laboratory experiments conducted to determine bubbler-induced heat transfer coefficients are reported. Implications and validity of results are discussed. As a second step, a procedure for computer-simulating the behavior of an ice sheet whose thickness is controlled by a bubbler system operating intermittently over a long period of time is developed. The simulation uses experimentally determined bubbler heat transfer coefficients, weather data, site characteristics, and desired performance as input data, and a finite difference method to solve the equations governing the ice thickness and temperature profile. Through an example simulation, the usefulness of the procedure in predicting ice thickness and temperature profile histories, and the effectiveness or suitability of a given bubbler system are demonstrated.

MP 1161
DECAY PATTERNS OF LAND-FAST SEA ICE IN CANADA AND ALASKA.
Bilello, M.A., Symposium on Sea Ice Processes and Models, Sep. 6-9, 1977. Proceedings, Vol.2, Seattle, University of Washington, 1977, p.1-10, 11 refs.
33-1392
SEA ICE, FAST ICE, ICE COVER THICKNESS, ICE DETERIORATION, METEOROLOGICAL FACTORS.

Weekly measurements of the thickness of land-fast sea ice made over a period of 10 to 15 years at a number of coastal locations in Canada and Alaska were analyzed. That portion of the data relating to maximum ice thickness and decay (i.e., the decrease in ice thickness) are presented and examined. Many meteorological and marine factors affect the decay process. This study investigates the effects of two important weather elements: air temperature and solar radiation. Complete and reliable air temperature data for each station made it possible to analyze the relationship between accumulated thawing degree-days (ATDD) and sea ice ablation. The relationship between ice decrease and daily accumulated solar radiation was investigated; the results were comparable to those derived when ATDD was used as the dependent variable. Other factors affecting ice ablation and breakup, such as snow-ice formation, snow cover depth, and wind, are also discussed in the study.

MP 1162
NEARSHORE ICE MOTION NEAR PRUDHOE BAY, ALASKA.
Tucker, W.B., et al, Symposium on Sea Ice Processes and Models, Sep. 6-9, 1977. Proceedings, Vol.2, Seattle, University of Washington, 1977, p.23-31, 7 refs.
Weeks, W.F., Kovacs, A., Gow, A.J.
33-1394
SEA ICE, DRIFT, ICE TEMPERATURE, THERMAL EXPANSION.

Shorefast and nearshore pack ice motions in the vicinity of Prudhoe Bay, Alaska, have been monitored for the spring seasons (March-June) of 1976 and 1977. From the base camp on Narwhal Island, a barrier island 25 km northeast of Prudhoe Bay, a ranging laser was used to measure distances to targets located on the fast ice within a 7 km radius of the island. To assess pack ice motions, a radar transponder system with tracking stations located on Narwhal and Cross Islands was used to monitor the positions of transponders placed on the pack ice as far as 37 km northeast of the islands. These results suggest that gyre movement or slippage of the nearshore pack ice in this area apparently does not begin until early to mid-summer. The pack ice in this area responds slowly, and only weakly to local winds. The mesoscale displacements that occurred took place only after several days of consistent offshore winds. This indicates that a significant shoreward stress originating in the more distant pack heavily influences the dynamics of this nearshore area.

MP 1163
CHARACTERIZATION OF THE SURFACE ROUGHNESS AND FLOE GEOMETRY OF THE SEA ICE OVER THE CONTINENTAL SHELVES OF THE BEAUFORT AND CHUKCHI SEAS.
Weeks, W.F., et al, Symposium on Sea Ice Processes and Models, Sep. 6-9, 1977. Proceedings, Vol.2, Seattle, University of Washington, 1977, p.32-41, 9 refs.
Tucker, W.B., Frank, M., Fungcharoen, S.
33-1395
SEA ICE DISTRIBUTION, SURFACE ROUGHNESS, SIDE LOOKING RADAR, PRESSURE RIDGES.

This paper reports on observations primarily made during the late winter and early spring of 1976 when the ice cover was at its maximum extent, and very few leads were observed. The primary sensors used were a laser profilometer and an X-band side-looking airborne radar (SLAR) system. The heaviest ridging was found at Barter Island and there was a general decrease in the number of ridges as one moved west into the Chukchi Sea. There was no strong variation in the mean ridge height along the coast. There was no systematic areal variation in mean ridge height normal to the coast. There was also no correlation between mean ridge height and the number of ridges per km as has been reported by previous investigators. An analysis was also made of the probability of encountering very large ridges. SLAR imagery gives the size distribution of multiyear ice floes within the nearshore ice pack, and the variation in the areal percentage of deformed ice as a function of distance from the coast. This latter parameter showed a steady decrease as the distance north of the coast increases.

MP 1164
MODELING PACK ICE AS A VISCOUS-PLASTIC CONTINUUM: SOME PRELIMINARY RESULTS.
Hibler, W.D., III, Symposium on Sea Ice Processes and Models, Sep. 6-9, 1977. Proceedings, Vol.2, Seattle, University of Washington, 1977, p.46-55, 21 refs.
33-1397
PACK ICE, VISCOUS FLOW, PLASTIC FLOW, ICE DEFORMATION, ICE MODELS, MATHEMATICAL MODELS.

A dynamic-thermodynamic model of pack ice is presented, which treats the ice as a nonlinear viscous continuum characterized by both bulk and shear viscosities and a pressure term with the viscosities being functions of the deformation rate and the pressure. The pressure is parameterized as a function of the compactness and mean thickness of the ice. This formulation allows the viscous continuum approach to be retained while allowing the system to deform in a plastic manner. The model is formulated in a fixed Eulerian grid, and the dynamical equations are coupled to continuity equations for compactness and mean ice thickness which include thermodynamic source and sink terms. In the numerical scheme the dynamical equations of motion, in finite difference form, are integrated implicitly and the ice thickness equations are integrated explicitly. The model is applied to the Arctic Basin and integrated at one-day steps for up to eight years in order to obtain steady state results for both ice thickness and drift. Two cases are examined.

MP 1165
FINITE ELEMENT FORMULATION OF A SEA ICE DRIFT MODEL.
Sodhi, D.S., et al, Symposium on Sea Ice Processes and Models, Sep. 6-9, 1977. Proceedings, Vol.2, Seattle, University of Washington, 1977, p.67-76, 10 refs.
Hibler, W.D., III.
33-1399
SEA ICE, DRIFT, MATHEMATICAL MODELS.

The complete boundary value problem of a linear viscous sea ice drift model is presented, using the finite element method; and the formulation includes the inertial force term in the governing equation of motion. The results of the computations of the steady-state ice velocities in the Arctic Ocean are presented, using mean seasonal geostrophic wind data and available current information. The effect of varying boundary conditions and the viscosity parameters is examined. On a much smaller scale, this model has been applied to the study of non-steady drift of pack ice through the Strait of Belle Isle (between Newfoundland and Labrador) where strong tidal streams and ocean currents move the pack ice back and forth. Using idealized sinusoidal variations of the tidal streams, it is found that the time lag between the water and the ice velocities is related to the viscosity parameters, which indicates that the ice is not drifting freely; and the boundaries affect the time constant of the simplified first order model of the ice drift through the Strait.

MP 1166
INVESTIGATION OF A VLF AIRBORNE RESISTIVITY SURVEY CONDUCTED IN NORTHERN MAINE.
Arcone, S.A., *Geophysics,* Dec. 1978, 43(7), p.1399-1417, 26 refs.
33-1573
ELECTRICAL RESISTIVITY, AERIAL SURVEYS, VERY LOW FREQUENCIES, TOPOGRAPHIC EFFECTS, ELECTRIC FIELDS.

Airborne wavetilt resistivity surveys and profiles at VLF have been analyzed for the effects of topography, altitude, and wavetilt phase and amplitude. Topographic relief is known to affect at least one electric field component, flight altitude often varies over relief, and phase depends on the earth's resistivity stratification and the relative strength of displacement to conduction current. A mountainous area in northern Maine of predominantly slate, but containing an igneous stock, was surveyed at 150 m mean flight altitude. The 150-m survey was repeated at 300 m and two of the 150-m flight lines were repeated at a total of three other altitudes. A comparison of the 150-m survey with the topography and with the 300-m survey revealed that although most of the resistivity information of the 150-m survey was retained at 300 m, serious differences arose due to topographic influences. Profiles of the individual electric field components at the various altitudes then revealed that topography was distorting resistivity values through its effect upon only the vertical component of the electric field. The separate influences of phase and amplitude were analyzed using the results of a ground survey of the total, complex surface impedance. The phase of the tilt proved to be important in the airborne differentiation of the rock types.

MP 1167
USE OF REMOTE SENSING TO QUANTIFY CONSTRUCTION MATERIAL AND TO DEFINE GEOLOGIC LINEAMENTS, DICKEY-LINCOLN SCHOOL LAKES PROJECT, MAINE.
McKim, H.L., et al, International Symposium on Remote Sensing of Environment, 12th, Manila. Proceedings, 1978, 9 leaves, 7 refs.
Merry, C.J., Blackey, E.A.
33-1584
REMOTE SENSING, CONSTRUCTION MATERIALS, GEOLOGIC STRUCTURES.

Fourteen surficial geology units were delineated in a 2850 sq km area in northern Maine. These units included: alluvial fan, alluvial terrace, esker, floodplain, glacial moraine, kame, kame terrace, outwash, outwash terrace, bedrock, till, till over bedrock, wet outwash and wet till. The surficial geology units were field checked and then updated from the field reconnaissance. The depths of the surficial geology units were estimated utilizing borehole data, field measurements and seismometer data. The areal extent of each surficial geology unit was quantified, using a planimetric color densitometer. The volumes of construction material were computed based upon these areal determinations and estimated depths. The volume estimates, compared with the estimates of required construction material, showed that more material could be found within the prescribed area around the dam and dike sites than was required for construction. It is believed that the east- and northeast-trending lineaments in this area are thrust faults dipping 45 deg to the northeast. The north-trending and N60W lineaments are probably strike-slip normal and reverse faults dipping 80 deg to nearly vertical. Future movement along these faults should be negligible.

MP 1168

CREEP RUPTURE AT DEPTH IN A COLD ICE SHEET.

Colbeck, S.C., et al, *Nature*, Oct. 26, 1978, 275(5682), p.733, 13 refs.
St. Lawrence, W.F., Gow, A.J.
33-1616
ICE SHEETS, ICE CREEP, FRACTURING, SEISMIC SURVEYS.

Experimental evidence has not supported the hypothesis that tectonic processes operating within glaciers and ice sheets are analogous to those in the Earth. However, evidence of the existence of discrete shear planes within the antarctic ice sheet (31-1071 or F-17742) and evidence described here relating to the Greenland ice sheet indicate that faulting takes place at depth in cold ice sheets. The evidence suggests reconsideration of the concept of correspondence between flow and rupture at depth in the Earth and in cold ice sheets, as suggested earlier. Direct investigations at depth in ice sheets are made with relative ease as compared to the nearly impossible task of direct measurements in the Earth's mantle.

MP 1169

EFFECT OF INUNDATION ON VEGETATION AT SELECTED NEW ENGLAND FLOOD CONTROL RESERVOIRS.

McKim, H.L., et al, Symposium on Remote Sensing for Vegetation Damage Assessment, February 1978. Proceedings, 1978, 13p., 13 refs.
Gatto, L.W., Merry, C.J., Cooper, S.
33-1519
REMOTE SENSING, INFRARED PHOTOGRAPHY, VEGETATION PATTERNS, DAMAGE, FLOODING.

The effect of inundation on vegetation caused by the regulation and impoundment of water at six New England flood control reservoirs during a June-July 1973 flood was assessed from color infrared photography and corroborative ground surveys. Percent of damaged trees was assessed on a pattern recognition and coloration basis. Correlative ground truth data showed that the deciduous trees, particularly silver maple and red oak, were least affected and that coniferous trees, especially white pine, were most affected by siltation and inundation. Much of the understory vegetation, i.e., American and Eastern hop hornbeam, lost all leaves after inundation, but new buds and shoots appeared by late September 1973. A critical relationship, determined from ground transect profiles showing the relationship between species susceptibility and inundation time, was that trees completely covered by flood waters for more than 90 hours showed the most apparent damage.

MP 1170

INVESTIGATION OF ICE CLOGGED CHANNELS IN THE ST. MARYS RIVER.

Mellor, M., et al, *U.S. Coast Guard. Report*, Mar. 1978, USCG-D-22-78, 73p., ADA-058 015.
Vance, G.P., Wuebben, J.L., Frankenstein, G.E.
33-1748
ICE BREAKING, ICE JAMS, CHANNELS (WATERWAYS), COST ANALYSIS.

This study addresses itself to the problem of removing brash ice from Frechette Point to Six-Mile Point of the Little Rapids Cut of the St. Marys River system. The area and river system are described and estimates are made for partially clearing a channel 250 ft wide. Rough costs, based on dollars per horsepower, indicate that it would cost between 1 and 2 million dollars per clear channel mile per year.

MP 1171

DIELECTRIC PROPERTIES OF DISLOCATION-FREE ICE.

Itagaki, K., *Journal of glaciology*, 1978, 21(85), p.207-217, In English with French and German summaries. 20 refs.
33-1867
ICE CRYSTALS, HOARFROST, DISLOCATIONS (MATERIALS), ICE ELECTRICAL PROPERTIES.

Dielectric properties of dislocation-free hoar-frost ice crystals were measured in the audio-frequency range. Anomalously small relaxation strength was found in the dislocation-free area of the crystal samples, while dislocations deliberately introduced by scratching the samples drastically modified the relaxation strength. Since measurements made in the area of high dislocation density indicated normal behavior, electrically charged dislocations are considered to be the source of the normally observed dielectric relaxation.

MP 1172

REGELATION AND THE DEFORMATION OF WET SNOW.

Colbeck, S.C., et al, *Journal of glaciology*, 1978, 21(85), p.639-650, In English with French and German summaries. 17 refs.
Parssinen, N.
33-1901
WET SNOW, REGELATION, SNOW DEFORMATION, MODELS.

The thermodynamics of phase equilibrium control the temperature distribution around the ice particles in wet snow. When the snow is stressed, pressure melting occurs at the interparticle contacts and the snow densifies. Densification is described by a physical model which simulates the heat flow, meltwater flow, and particle geometry. The effects of ionic impurities, liquid saturation, and particle size are demonstrated. Typical values of the temperature difference, inter-particle film size, and density are calculated as functions of time. The calculated rates of compaction are too large; hence, at some later time, the effects of simultaneous grain growth must be added to the model.

MP 1173

FUNDAMENTALS OF ICE LENS FORMATION.

Takagi, S., *American Institute of Chemical Engineers. AICHE symposium series*, 1978, 74(174), p.235-242, 27 refs. See also 32-3470 and 32-4368.
33-2083
ICE LENSES, ICE FORMATION, SOIL WATER, SOIL FREEZING, HEAT TRANSFER, FROST HEAVE, ANALYSIS (MATHEMATICS).

A new concept of the freezing of water, called segregation freezing, is proposed to explain the creation of the suction force that draws pore water up to the interface of a growing ice lens. The temperature of segregation freezing is shown to be lower than that of normal freezing (in situ freezing). This difference determines the pressure that the ice lens exerts while growing and carrying the overlying weight. On the assumption that the soil structure is rigid, equations governing the simultaneous flow of heat and water are formulated and solved for the limit of time t to 0 with the combination of analytical and numerical methods. Numerical computation of the solution yields a result that is reasonable, compared with experience in laboratory and nature.

MP 1174

ISUA, GREENLAND: GLACIER FREEZING STUDY.

Ashton, G.D., *American Institute of Chemical Engineers. AICHE symposium series*, 1978, 74(174), p.256-264, 9 refs.
33-2086
GLACIER FLOW, CREEP, ICE REFRIGERATION, MINING, DRILLING, ANALYSIS (MATHEMATICS), ICE TEMPERATURE.

A scheme for cooling the lower portion of the edge of the Greenland ice sheet, which abuts a potential mining operation is examined. At the mine site, the ore body is overlain with ice. Once the overburden is removed, however, the adjacent ice is expected to flow toward the pit. One possible means of slowing this movement is to cool the ice below its present temperature to achieve a reduction in the creep rate and a retardiation of basal slip. The present study examines analytically the magnitude of cooling which may be accomplished by drilling a series of vertical holes about the periphery of the mine site. Refrigeration is accomplished by pumping a coolant downhole in a central pipe, then uphole in an annulus between the pipe and hole wall, and then through a thin walled pipe exposed to the cold surface climate above the ice sheet. Results of example calculations for various particular combinations of the free parameters are examined and include cooling requirements, hold spacing, pump requirements, and other parameters. Over a period of operation on the order of a year of more, it appears possible to cool a substantial part of the lower area of the glacier on the order of -1 to -2C, using a hole spacing that is considered reasonable. The results of the study are to be used as input to a detailed glacier flow study.

MP 1175

REMOTE DETECTION OF MASSIVE ICE IN PERMAFROST ALONG THE ALYESKA PIPELINE AND THE PUMP STATION FEEDER GAS PIPELINE.

Kovacs, A., et al, ASCE Pipeline Division Specialty Conference, New Orleans, Louisiana, Jan. 15-17, 1979. Proceedings. Pipelines in adverse environments; a state of the art, Vol.1, New York, N.Y., American Society of Civil Engineers, 1979, p.268-279, 10 refs.
Morey, R.M.
33-2077
PERMAFROST STRUCTURE, PERMAFROST PHYSICS, ICE DETECTION, SUBSURFACE INVESTIGATIONS, REMOTE SENSING, RADAR ECHOES, GROUND ICE, ICE FORMATION, SOUNDING, REFLECTIVITY, PIPELINES.

Field soundings using an impulse radar system were carried out during May 1976 along a section of the Alyeska Pipeline near Pump Station 3 and the pump station feeder gas pipeline trench near the Happy Valley Camp, Alaska. The radar system, operating on the ground, provided a continuous profile of the near-surface geological structure of the permafrost. A unique dual antenna configuration produced two profiles, a vertical profile and an offset profile, from which the velocity of the radar signal at any point along the traverse could be calculated and from which a representative depth scale for the subsurface profile was determined. The profile results proved useful in identifying regions of massive ice in the permafrost. Logs from holes drilled for the oil pipeline's Vertical Support Members are compared with the radar profile data. This comparison shows that the radar detected the top and bottom of massive ice to a depth of approximately 30 ft.

MP 1176

RESILIENT RESPONSE OF TWO FROZEN AND THAWED SOILS.

Chamberlain, E.J., et al, *American Society of Civil Engineers. Geotechnical Engineering Division. Journal*, Feb. 1979, 5(GT2), p.257-271, 13 refs.
Cole, D.M., Johnson, T.C.
33-2178
SUBGRADE SOILS, SEASONAL FREEZE THAW, SOIL MECHANICS, STRESSES, LOW TEMPERATURE TESTS.

Values of resilient modulus and Poisson's ratio were determined for silt and clay subgrade materials subjected to seasonal freezing and thawing. A new technique employing noncontacting variable impendance transducers was employed to obtain radial strain data for calculation of Poisson's ratio. The data were analyzed using multiple linear regression and analysis of variance techniques to obtain empirical relationships between the resilient moduli and Poisson's ratio parameters and stress and material property variables. Resilient modulus data ranged from over 6,000,000 psi for the frozen condition to less than 600 psi for the thawed condition. Poisson's ratio ranged from 0.07 to 0.61, the majority of the values falling between 0.03 and 0.50.

MP 1177

OXYGEN ISOTOPE INVESTIGATION OF THE ORIGIN OF THE BASAL ZONE OF THE MATANUSKA GLACIER, ALASKA.

Lawson, D.E., et al, *Journal of geology*, 1978, Vol.86, p.673-685, 34 refs.
Kulla, J.B.
33-2287
GLACIER ICE, ICE STRUCTURE, OXYGEN ISOTOPES, THERMODYNAMIC PROPERTIES.

An analysis of the oxygen isotope content of ice of the englacial and basal zones of the Matanuska Glacier at its terminus reveals the origin of the ice and entrained debris. The decrease with depth in the change of O18 values of ice of the diffused facies of the englacial zone and the dispersed facies of the basal zone is consistent with previous studies and indicates this ice originates in the accumulation area. Characteristics of the ice and debris of the dispersed facies indicate a subglacial source for most of the debris. The sharp increase of more than 4 per mill in the change of O18 values of ice of the lower, stratified facies of the basal zone and its young radiocarbon age indicate this facies formed by subglacial freezing of isotopically enriched meltwater, probably surface-derived, to the glacier sole. The bubble-poor, fine-grained ice, thickness, stratification, rounded pebbles, and undisturbed sedimentary structures in this facies support this conclusion. The location, extent, and rates of subglacial ice formation and sediment entrainment vary. The Matanuska Glacier is therefore thermally complex, with zones of ice at the glacier sole that are at or below the pressure-melting point.

MP 1178

RIVER ICE.

Ashton, G.D., *American scientist*, Jan./Feb. 1979, 67(1), p.38-45, 21 refs.
33-2288
RIVER ICE, ICE FORMATION, ICE JAMS, ICE GROWTH, THERMAL POLLUTION, TEMPERATURE EFFECTS.

MP 1179

MEASUREMENT OF MESOSCALE DEFORMATION OF BEAUFORT SEA ICE (AIDJEX-1971).

Hibler, W.D., III, et al, *Problems of the Arctic and the Antarctic; collection of articles*, 1978, Vol.43-44, p.148-172, TT-75-52082, For Russian version see 29-2023. 21 refs.
Weeks, W.F., Ackley, S.F., Kovacs, A., Campbell, W.J.
33-2376
PACK ICE, ICE DEFORMATION, DRIFT, AERIAL SURVEYS, ICE REPORTING.

MP 1180

ORIGIN AND PALEOCLIMATIC SIGNIFICANCE OF LARGE-SCALE PATTERNED GROUND IN THE DONNELLY DOME AREA, ALASKA.

Péwé, T.L., et al, *Geological Society of America. Special paper*, 1969, No.103, 87p., Bibliography p.79-84. In English with French, German, and Russian summaries.
Church, R.E., Andresen, M.J.
25-3645
PATTERNED GROUND, SEDIMENTS, PERIGLACIAL PROCESSES, ICE WEDGES, PERMAFROST, UNITED STATES—ALASKA—DONNELLY DOME.

MP 1181
HYDRAULIC TRANSIENTS: A SEISMIC SOURCE IN VOLCANOES AND GLACIERS.
St. Lawrence, W.F., et al, *Science*, Feb. 16, 1979, 203(4381), p.654-656, 10 refs.
Qamar, A.
33-2727
WAVE PROPAGATION, GLACIERS, VOLCANOES, EARTHQUAKES.

A source for certain low-frequency seismic waves is postulated in terms of the water hammer effect. The time-dependent displacement of a water-filled subglacial conduit is analyzed to demonstrate the nature of the source. Preliminary energy calculations and the observation of hydraulically generated seismic radiation from a dam indicate the plausibility of the proposed source.

MP 1182
TERMINAL BALLISTICS IN COLD REGIONS MATERIALS.
Aitken, G.W., International Symposium on Ballistics, 4th. Proceedings, Monterey, California, U.S. Naval Postgraduate School, 1978, 6p., 11 refs.
33-2729
PROJECTILE PENETRATION, PENETRATION TESTS, FROZEN GROUND, SNOW COVER.

In a winter environment, snow and frozen soil may be the most readily available materials for use in field fortifications. Design of effective fortifications requires detailed knowledge of the response of these materials to impact from projectiles and projectile fragments. Data for small arms projectile and simulated projectile fragment penetration into snow and frozen soil are presented. Results of penetration predictions made using both closed form and empirical solutions are compared with test results, and the prediction techniques themselves are discussed. Basic agreement between predicted and measured penetrations was obtained for the simulated projectile fragments, which tended to remain stable in the target materials. Penetration of 7.62 mm small arms projectiles into frozen soil targets is also predictable at velocities below about 600 m/s, above which they tend to become unstable and tumble in the target. In the case of the empirical solution, the results presented serve to extend its range of applicability to projectiles weighing less than 0.9 kg.

MP 1183
INTRODUCTION TO THE WORKSHOP ON ECOLOGICAL EFFECTS OF HYDROCARBON SPILLS IN ALASKA.
Atlas, R.M., et al, *Arctic*, Sep. 1978, 31(3), p.155-157.
Brown, J.
33-2786
MEETINGS, OIL SPILLS, RESEARCH PROJECTS.

MP 1184
EFFECTS OF CRUDE AND DIESEL OIL SPILL ON PLANT COMMUNITIES AT PRUDEHOE BAY, ALASKA, AND THE DERIVATION OF OIL SPILL SENSITIVITY MAPS.
Walker, D.A., et al, *Arctic*, Sep. 1978, 31(3), p.242-259, In English with French summary. 29 refs.
Webber, P.J., Everett, K.R., Brown, J.
33-2793
OIL SPILLS, ENVIRONMENTAL IMPACT, TUNDRA VEGETATION, INDEXES (RATIOS), MAPS.

Crude oil was spilled on six of the major Prudhoe Bay plant communities at an intensity of 12 liters/sq m. The communities occurred along a topographic-moisture gradient. The reaction of the major species of the various communities was recorded one year following the spills. Sedges and willows showed substantial recovery from crude oil spills. Mosses, lichens, and most dicotyledons showed little or no recovery. On a very wet plot with standing water, the vegetation showed very poor recovery. *Dryas integrifolia* M. Vahl, the most important vascular species on dry sites, was killed. Identical experiments using diesel oil rather than crude oil showed all species except an aquatic moss to be killed. A sensitivity index for the communities was calculated on the basis of the percentage cover of the resistant species divided by the original total plant cover of the community. With this information an oil spill sensitivity map for an area of Prudhoe Bay was constructed using a vegetation map as a base. Using the crude oil data from Prudhoe Bay together with some from the literature, a predictive sensitivity map was also constructed for an accidental crude oil spill at nearby Franklin Bluffs. In this example all the community types are considered to have moderate to excellent recovery potential.

MP 1185
PHYSICAL, CHEMICAL AND BIOLOGICAL EFFECTS OF CRUDE OIL SPILLS ON BLACK SPRUCE FOREST, INTERIOR ALASKA.
Jenkins, T.F., et al, *Arctic*, Sep. 1978, 31(3), p.305-323, 36 refs.
Johnson, L.A., Collins, C.M., McFadden, T.
33-2797
OIL SPILLS, ENVIRONMENTAL IMPACT, FOREST TUNDRA, VEGETATION, DAMAGE.

MP 1186
FATE OF CRUDE AND REFINED OILS IN NORTH SLOPE SOILS.
Sexstone, A., et al, *Arctic*, Sep. 1978, 31(3), p.339-347, In English with French summary. 6 refs.
Everett, K.R., Jenkins, T,F., Atlas, R.M.
33-2799
OIL SPILLS, TUNDRA SOILS, HYDROCARBONS, MICROBIOLOGY.

Prudhoe Bay crude oil and refined diesel fuel were applied to five topographically distinct tundra soils at Prudhoe Bay, Alaska. The penetration of hydrocarbons into the soil column depended on soil moisture and drainage characteristics. Biodegradation, shown by changes in the pristane to heptadecane and resolvable to total gas chromatographic area ratios, appeared to be greatly restricted in drier tundra soils during one year exposure. Some light hydrocarbons were recovered from soils one year after spillages. Hydrocarbons were still present in soils at Fish Creek, Alaska, contaminated by refined oil spillages 28 years earlier, attesting to the persistence of hydrocarbons in North Slope soils.

MP 1187
STUDY OF SEVERAL PRESSURE RIDGES AND ICE ISLANDS IN THE CANADIAN BEAUFORT SEA.
Hnatiuk, J., et al, *Journal of glaciology*, 1978, 20(84), p.519-532, In English with French and German summaries. 3 refs.
Kovacs, A., Mellor, M.
33-2885
PRESSURE RIDGES, ICE ISLANDS, ICE COVER THICKNESS, PROFILES.

The environmental conditions in the southern Beaufort Sea are described, with special emphasis on pressure ridges and ice islands. Techniques for determining the geometric configurations and the physical and mechanical properties of sea-ice structures and ice islands are described. Profiles of pressure ridges were determined by surface surveys, drill-hole probes and side-looking sonar scanning. Multi-year pressure ridges with thicknesses up to 20 m and widths up to 120 m were examined in detail. The first-year ridge of 22 m thickness and 100 m width was studied. Results are given for several multi-year and the first-year ridges. Information obtained from dives under the ice is also given. Corresponding data are given for grounded ice islands, with emphasis on contact between the ice and sea bed. A 20 m thick ice-island fragment grounded in 15 m of water was one of several investigated. Measurements of temperature, salinity, tensile strength, and compressive strength are given for ice taken from old pressure ridges; and factors influencing the interpretation of test data are discussed.

MP 1188
FULL-DEPTH PAVEMENT CONSIDERATIONS IN SEASONAL FROST AREAS.
Eaton, R.A., et al, *U.S. Army Cold Regions Research and Engineering Laboratory*, Feb. 1979, 24p., 8 refs. Paper presented at the annual meeting of the Association of Asphalt Paving Technologists, Denver, Colorado, Feb. 15-17, 1979.
Joubert, R.H.
33-2904
BITUMINOUS CONCRETES, SEASONAL FREEZE THAW, FROST RESISTANCE, FROST PENETRATION, SUBGRADE PREPARATION, FROST HEAVE.

Two full-depth pavement sections were built on highly frost-susceptible subgrades that had been properly prepared. Suitable structural and service performances were achieved in spite of substantial, though uniform, frost heaves. A full-depth pavement built on a local municipal street has not approached structural failure. However, poor service performance caused by differential heaves and severe differences at surface castings has resulted. This paper reports on these studies and attempts to underscore the importance of proper design and construction of pavements on highly frost-susceptible soils. Particular emphasis is placed on the quality of subgrade preparation. Finally, the incorporation of transition sections at surface castings is considered necessary to diminish differential heave at the castings.

MP 1189
DESIGN OF AIRFIELD PAVEMENTS FOR SEASONAL FROST AND PERMAFROST CONDITIONS.
Berg, R.L., et al, *U.S. Army Cold Regions Research and Engineering Laboratory*, Oct. 1978, 18p., Presented at the U.S. Air Force Worldwide Pavements Conference, Panama City Beach, Florida, Oct. 24-26, 1978.
Johnson, T.C.
33-2905
AIRPORTS, BITUMINOUS CONCRETES, SUBGRADE PREPARATION, SEASONAL FREEZE THAW, FROST PENETRATION, FROST HEAVE.

MP 1190
SINTERING AND COMPACTION OF SNOW CONTAINING LIQUID WATER.
Colbeck, S.C., et al, *Philosophical magazine A*, Jan. 1978, 39(1), p.13-32, Refs. p.31-32.
33-2982
SNOW COMPACTION, SNOW MECHANICS, FIRNIFICATION, ICE DENSITY, SALINITY, MELTWATER, WET SNOW.

MP 1191
ELEMENTAL ANALYSES OF ICE CRYSTAL NUCLEI AND AEROSOLS.
Kumai, M., International Conference on Atmospheric Aerosols, Condensation and Ice Nuclei, 9th, Galway, Ireland, Sep. 21-27, 1977. Proceedings, Galway, Ireland, University College, 1977, 5p., 11 refs.
33-2962
ICE NUCLEI, AEROSOLS, ELECTRON MICROSCOPY, X RAY ANALYSIS.

Ice crystal nuclei and aerosols in Fairbanks, Alaska were studied using a scanning electron microscope and energy-dispersive X-ray analyzer. It is thought that the origins of the ice nuclei and aerosols are mainly solid combustion by products from local electric power plants and other combustion sources.

MP 1192
ICE FOG SUPPRESSION USING THIN CHEMICAL FILMS.
McFadden, T., et al, *U.S. Environmental Protection Agency. Report*, Jan. 1979, EPA-600/3-79-007, 44p., 20 refs.
Collins, C.M.
33-2959
ICE FOG, FOG DISPERSAL, CHEMICAL REACTIONS.

Ice fog suppression experiments on the Fort Wainwright Power Plant cooling pond were conducted during the winter of 1974-76. Hexadecanol was added to the pond and dramatically improved visibility by reducing fog generated from water vapor released by the pond at -14C. Although this temperature was not low enough to create ice fog, the cold vapor fog created was equally as devastating to visibility in the vicinity of the pond. During the winter of 1975-76, suppression tests were continued using films of hexadecanol, mixes of hexadecanol and octadecanol, and ethylene glycol monobutyl ether (EGME). Suppression effectiveness at colder temperatures was studied and limits to the techniques were probed. A reinforcing grid was constructed that prevented breakup of the film by wind and water currents. Lifetime tests indicated that EGME degrades much more slowly than either hexadecanol or the hexadecanol-octadecanol mix. All the films were found to be very effective fog reducers at warmer temperatures but still allowed 20% to 40% of normal evaporation to occur. The vapor thus produced was sufficient to create some ice fog at lower temperatures, but this ice fog occurred less frequently and was more quickly dispersed than the thick fog that was present before application of the films.

MP 1193
PROCEEDINGS.
Colloquium on Planetary Water and Polar Processes, 2nd, Hanover, N.H., Oct. 16-18, 1978, Hanover, N.H., U.S. Army Cold Regions Research and Engineering Laboratory, 1978, 209p., For selected papers see 33-3058 through 33-3080.
33-3057
MEETINGS, MARS (PLANET), PLANETARY ENVIRONMENTS, PERMAFROST HYDROLOGY, GEOLOGIC STRUCTURES, WATER.

MP 1194
DEVELOPMENT OF A SIMPLIFIED METHOD FOR FIELD MONITORING OF SOIL MOISTURE.
Walsh, J.E., et al, Colloquium on Planetary Water and Polar Processes, 2nd, Oct. 1978. Proceedings, Hanover, N.H., U.S. Army Cold Regions Research and Engineering Laboratory, 1978, p.40-44, Includes comments. 3 refs.
McQueeney, D., Layman, R.W., McKim, H.L.
33-3059
SOIL WATER, MEASURING INSTRUMENTS, ELECTRIC EQUIPMENT.

MP 1195
VIKING GCMS ANALYSIS OF WATER IN THE MARTIAN REGOLITH.
Anderson, D.M., et al, Colloquium on Planetary Water and Polar Processes, 2nd, Oct. 1978. Proceedings, Hanover, N.H., U.S. Army Cold Regions Research and Engineering Laboratory, 1978, p.55-61, Includes comments. 7 refs.
Tice, A.R.
33-3060
GROUND WATER, MARS (PLANET), SOIL TESTS, GAS INCLUSIONS.

MP 1197

ICE BLOCKAGE OF WATER INTAKES.

Carey, K.L., *U.S. Nuclear Regulatory Commission. Contractor report,* Mar. 1979, NUREG/CR-0548, 27p., 19 refs.

33-3113

WATER INTAKES, FRAZIL ICE, BOTTOM ICE, ICE COVER.

Ice blockage of water intake structures can pose serious threats to the availability of cooling water at thermal power plants. Ice blockage difficulties are described as they may occur in rivers, lakes, reservoirs, and estuaries, and as they may affect intakes either at the surface or submerged. Characteristics of both surface sheet ice and frazil ice are examined: formational processes, sizes, thicknesses, movement or mobility, and modes of blockage or adhesion. Case histories of incidents of ice blockage of intakes are given. Solving ice blockage problems, either through original design, post-construction modification, or revised operational techniques is discussed.

MP 1198

EFFECT OF THE OCEANIC BOUNDARY LAYER ON THE MEAN DRIFT OF PACK ICE: APPLICATION OF A SIMPLE MODEL.

McPhee, M.G., *Journal of physical oceanography,* Mar. 1979, 9(2), p.388-400, 14 refs. For this paper from another source, see 32-4551.

33-3216

PACK ICE, DRIFT, BOUNDARY VALUE PROBLEMS, MATHEMATICAL MODELS, ICE WATER INTERFACE.

Smoothed records of ice drift, surface wind and upper ocean currents at four manned stations of the 1975-76 AIDJEX experiment in the central Arctic have been analyzed to provide a statistical relationship between stress at the ice-ocean interface and ice-drift velocity during a 60-day period when the ice was too weak to support internal forces. Essential features of the model are dynamic scaling for velocity, kinematic stress and length, with exponential attenuation of a linear dimensionless eddy viscosity. Currents measured 2 m below the ice confirmed the shape of the stress vs ice speed curve and provided an estimate of the angle between surface stress and velocity. The model was used to qualitatively estimate the effect of a pycnocline at 25 m on surface characteristics. The observed behavior when stratification at that level was most pronounced tended toward slightly higher drag at higher speeds, which is qualitatively consistent with the model results.

MP 1199

CURRENT RESEARCH ON SNOW AND ICE REMOVAL IN THE UNITED STATES.

Minsk, L.D., *Neve international,* Sep. 1978, 20(3), p.21-22.

33-3272

SNOW REMOVAL, ICE REMOVAL, ICE CONTROL, CHEMICAL ICE PREVENTION, ICE PREVENTION.

MP 1200

DYNAMICS OF NEAR-SHORE ICE.

Kovacs, A., et al, Environmental assessment of the Alaskan continental shelf, Vol.3. Principal investigators' quarterly reports for the period July-September 1977, Boulder, Colorado, Environmental Research Laboratories, 1977, p.503-510, PB-279 913.

Weeks, W.F.

33-3323

PACK ICE, DRIFT, RADAR ECHOES, ICE COVER THICKNESS, ICE DEFORMATION, DATA PROCESSING.

MP 1201

DELINEATION AND ENGINEERING CHARACTERISTICS OF PERMAFROST BENEATH THE BEAUFORT SEA.

Sellmann, P.V., et al, Environmental assessment of the Alaskan continental shelf, Vol.3. Principal investigators' quarterly reports for the period July-September 1977, Boulder, Colorado, Environmental Research Laboratories, 1977, p.518-521, PB-279 913.

Brown, J., Blouin, S.E., Chamberlain, E.J., Iskandar, I.K., Ueda, H.T.

33-3324

SUBSEA PERMAFROST, DRILL CORE ANALYSIS.

MP 1202

ULTRASONIC MEASUREMENTS ON DEEP ICE CORES FROM ANTARCTICA.

Gow, A.J., et al, *Antarctic journal of the United States,* Oct. 1978, 13(4), p.48-50, 3 refs.

Kohnen, H.

33-3350

ICE CORES, ULTRASONIC TESTS, ICE CRYSTAL STRUCTURE, ANTARCTICA—BYRD STATION.

This report discusses some results of recent measurements of ultrasonic velocities performed on ice cores collected in 1968 at Byrd Station. The analytical technique is described. It is concluded that measurement of ultrasonic velocities of cores from deep drill holes enables monitoring of the relation characteristics of the cores and determination of the gross trends of c-axis orientation in the ice sheet. Supplemented by optical thin section, studies can verify the exact nature of the fabric at any given depth and any inclination of the fabric symmetry axis with respect to the direction of propagation of P-wave velocity.

MP 1203

SEA ICE AND ICE ALGAE RELATIONSHIPS IN THE WEDDELL SEA.

Ackley, S.F., et al, *Antarctic journal of the United States,* Oct. 1978, 13(4), p.70-71, 7 refs.

Taguchi, S., Buck, K.R.

33-3363

SEA ICE, PACK ICE, ALGAE, CRYOBIOLOGY, ICE BREAKUP, CHEMICAL COMPOSITION, WEDDELL SEA.

Analysis of data obtained during a 1977 cruise in the Weddell Sea indicates that the ice algal community found during that cruise is distinct from others that have been described (for example, the bottom epontic community in the land-fast ice in McMurdo Sound, the surface communities off East Antarctica, and the bottom communities in Arctic Pack ice.) Unlike these other communities, the Weddell pack algae is dominantly an interior one, existing not at the surface or bottom but at mid-depth (.65 to 2.15 m) within the ice. The formation of this community is dependent on the unique thermal and physical setting for Weddell sea pack ice. Brine drainage processes are initiated by summer warming, but are not carried through to completion as in the Arctic. This process causes a redistribution of salinity, maximizing in the mid-depth regions of the ice and apparently leading to algae production because of the relatively higher nutrient levels at these mid-depths. A qualitative model indicating the relationship between the thermally induced brine migration and subsequent algae growth is given.

MP 1204

ENVIRONMENTAL ATLAS OF ALASKA.

Hartman, C.W., et al, Fairbanks, University of Alaska, 1978, 95p., 2nd ed. For 1st ed. see 24-4007. 44 refs.

Johnson, P.R.

33-3460

SEA WATER, RIVERS, CLIMATE, INDEXES (RATIOS), PHYSICAL PROPERTIES, UNITED STATES—ALASKA.

MP 1205

DYNAMICS OF NEAR-SHORE ICE.

Kovacs, A., et al, *Environmental assessment of the* Alaskan continental shelf, Vol.11, Hazards. Principal investigators' annual reports for the year ending March 1978. Boulder, Colorado, Outer Continental Shelf Environmental Assessment Program, 1978, p.11-22.

Weeks, W.F.

33-3591

SEA ICE, DRIFT, ICE COVER THICKNESS, RADAR ECHOES, ICE STRUCTURE, PRESSURE RIDGES.

MP 1206

DELINEATION AND ENGINEERING CHARACTERISTICS OF PERMAFROST BENEATH THE BEAUFORT SEA.

Sellmann, P.V., et al, Environmental assessment of the Alaskan continental shelf, Vol.11, Hazards. Principal investigators' annual reports for the year ending March 1978. Boulder, Colorado, Outer Continental Shelf Environmental Assessment Program, 1978, p.50-74.

Chamberlain, E.J.

33-3593

SUBSEA PERMAFROST, BOTTOM SEDIMENT, BOREHOLES, TEMPERATURE MEASUREMENT.

Observations include determinations of subsea sediment temperature, type, ice content, and chemical composition. These data, coupled with geophysical studies and results from other Beaufort Sea geological studies, are being used jointly to ascertain subsea permafrost distribution. This report includes a summary of the spring 1977 field program and a general summation of the results from two years of field study in the Prudhoe Bay area. The 1977 field study produced six additional drilled and sampled holes plus 27 probe sites which yielded both material property and temperature data. The field observations and the results of laboratory analyses of the samples help to demonstrate the complex nature of subsea permafrost.

MP 1207

MECHANICAL PROPERTIES OF POLYCRYSTALLINE ICE: AN ASSESSMENT OF CURRENT KNOWLEDGE AND PRIORITIES FOR RESEARCH.

Hooke, R.L., et al, [1979], 16p., Report of the International Commission on Snow and Ice/National Science Foundation working group on ice mechanics.

Mellor, M., Jones, S.J., Martin, R.T., Meier, M.F., Weertman, J.

33-3545

ICE MECHANICS, ICE CRYSTALS, ICE CREEP, ICE DEFORMATION, STRAIN TESTS, STRESS STRAIN DIAGRAMS, ICE STRENGTH.

MP 1209

PROJECTED THERMAL AND LOAD-ASSOCIATED DISTRESS IN PAVEMENTS INCORPORATING DIFFERENT GRADES OF ASPHALT CEMENT.

Johnson, T.C., et al, *Association of Asphalt Paving Technologists. Technical sessions. Proceedings,* 1979, Vol.48, p.403-437, 35 refs.

Shahin, M.Y., Dempsey, B.J., Ingersoll, J.

33-3865

BITUMINOUS CONCRETES, BITUMENS, LOW TEMPERATURE TESTS, FROST HEAVE, CRACKING (FRACTURING), THERMAL STRESSES, TEMPERATURE EFFECTS.

MP 1210

PHASE COMPOSITION MEASUREMENTS ON SOILS AT VERY HIGH WATER CONTENTS BY PULSED NUCLEAR MAGNETIC RESONANCE TECHNIQUE.

Tice, A.R., et al, *Transportation research record,* 1978, No.675, p.11-14, 22 refs.

Burrous, C.M., Anderson, D.M.

33-3863

FROZEN GROUND PHYSICS, UNFROZEN WATER CONTENT, NUCLEAR MAGNETIC RESONANCE, SOIL CHEMISTRY, SALINE SOILS.

A simple, rapid method of determining the unfrozen water content of frozen soils is described in detail. The method uses the first pulse amplitude of a pulsed nuclear magnetic resonance analyzer. Phase composition curves were obtained for four soils at very high total water contents. Three of the soils (Manchester fine sand, Fairbanks silt, and Goodrich clay) had been previously examined by another method (isothermal calorimeter). The fourth (Kotzebue silt) is a naturally saline soil found in low-lying coastal regions of Alaska. This soil was tested both in its natural state and with the soluble salts removed. The phase composition curves obtained by the nuclear magnetic resonance method are consistent with those obtained by using the isothermal calorimeter, but the nuclear magnetic resonance method saved time, requiring only 48h. It also provides a high degree of reproducibility and can be used over a wide range of temperatures. As expected, the unfrozen water content of the saline soil was much higher in its natural state than after removal of the soluble salts. In addition, the unfrozen water content of all four soils appears to increase somewhat as the total water content of the sample is increased.

MP 1211

PERMAFROST BENEATH THE BEAUFORT SEA, NEAR PRUDHOE BAY, ALASKA.

Sellmann, P.V., et al, Offshore Technology Conference, 11th. Proceedings, Houston, Texas, 1979, p.1481-1493, 34 refs.

Chamberlain, E.J.

33-3864

SUBSEA PERMAFROST, DRILL CORE ANALYSIS, PENETRATION TESTS, PERMAFROST DEPTH.

The occurrence and properties of subsea permafrost near Prudhoe Bay, Alaska, were investigated by drilling and probing. Nine holes were drilled and 27 sites were probed with a cone penetrometer. The deepest drill hole was 65.1m below the seabed, while a depth of 14.1 m was reached with the cone penetrometer. Engineering and chemical properties were determined from core samples and point penetration resistance data were obtained with the penetrometer. Thermal profiles were acquired at both the drill and probe sites.

MP 1212

COMPARATIVE TESTING SYSTEM OF THE APPLICABILITY FOR VARIOUS THERMAL SCANNING SYSTEMS FOR DETECTING HEAT LOSSES IN BUILDINGS.

Grot, R.A., et al, Infrared Information Exchange, 4th. Proceedings, St. Louis, Missouri, 1978, p.B71-B90, 18 refs.

Munis, R.H., Marshall, S.J., Greatorex, A.

33-3735

BUILDINGS, HEAT LOSS, TEMPERATURE MEASUREMENT, TESTS.

A two-stage program for determining the applicability of various remote thermal scanning systems for detecting heat losses in buildings is described. The types of instruments tested are high resolution thermal imaging systems, low resolution thermal imaging systems, thermal line scanners and point radiometers. The first phase of this project consisted of inserting known building defects into a specially designed room at the USA Cold Regions Research and Engineering Laboratory and having a representative of the manufacturer of each type of equipment inspect the room at three temperature differences across the room envelope. The second phase of this project will consist of a field evaluation of these same instruments in approximately 10 cities, in cooperation with a weatherization program for low-income housing sponsored by the Community Services Administration and directed by the National Bureau of Standards. The goal of the second phase is to determine the cost effectiveness of various remote thermal scanning services.

MP 1213
DETECTING WET ROOF INSULATION WITH A HAND-HELD INFRARED CAMERA.
Korhonen, C., et al, Infrared Information Exchange, 4th. Proceedings, St. Louis, Missouri, 1978, p.A9-A15, 5 refs.
Tobiasson, W.
33-3736
INFRARED PHOTOGRAPHY, ROOFS, MOISTURE, DETECTION.

Since 1975, CRREL has used hand-held infrared scanners for detecting wet insulation under built-up roof membranes. Thermocouples installed on roofs have shown that temperature differences between areas of wet and dry insulation may exist during both the day and night. The optimum time to detect these differences with an infrared camera is at night when solar interference is eliminated. Surveys have been conducted successfully in many locations from Alabama to Alaska during both warm and cold weather. Three-inch diameter core samples of the roof membrane and insulation have been obtained to verify infrared findings. This paper briefly overviews the technique used to survey roofs for moisture and then presents results of a controlled experiment at Pease AFB, New Hampshire, to show the correlation between thermal images and temperature differences observed thermoelectrically in wet and dry portions of a roof. Measurements of the thermal resistance of the wet and dry areas complete the physical picture.

MP 1214
REMOTE DETECTION OF WATER UNDER ICE-COVERED LAKES ON THE NORTH SLOPE OF ALASKA.
Kovacs, A., *Arctic,* Dec. 1978, 31(4), p.448-458, 9 refs.
33-3773
REMOTE SENSING, LAKE WATER, LAKE ICE, RADAR ECHOES, ICE COVER THICKNESS, WATER SUPPLY.

Results from using an impulse radar sounding system on the North Slope of Alaska to detect the existence of water under lake ice are presented. It was found that both lake ice thickness and depth of water under the ice could be determined when the radar antenna was either on the ice surface or airborne in a helicopter. The findings also revealed that the impulse radar sounding system could detect where lake ice was bottom-fast and where water existed under the ice cover.

MP 1215
GEOBOTANICAL STUDIES ON THE TAKU GLACIER ANOMALY.
Heusser, C.J., et al, *Geographical review,* Apr. 1954, 44(2), p.224-239, AD-030 651, 21 refs. Same as SIP-10697. Also issued as Report No.7, Contract n9onr83001.
Schuster, R.L., Gilkey, A.K.
33-3769
GLACIER FLOW, VEGETATION PATTERNS, GEOBOTANICAL INTERPRETATION, UNITED STATES—ALASKA—TAKU GLACIER.

MP 1216
RIVER ICE.
Ashton, G.D., Annual review of fluid mechanics, Vol.10, edited by M. Van Dyke, J.V. Wehausen, and J.L. Lumley, Palo Alto, California, Annual Reviews, 1978, p.369-392, 85 refs.
33-3953
RIVER ICE, ICE MECHANICS, ICE PRESSURE, FLUID MECHANICS.

The emphasis is on the fluid mechanical aspects of river ice including the areas of formation, evolution, and breakup of ice covers, hydraulics associated with the presence of ice, thermal effects and interactions with ice, and forces due to ice. River ice processes may be summarized as a series of steady states that exist between short periods of intense activity and change.

MP 1217
DETERMINING SUBSEA PERMAFROST CHARACTERISTICS WITH A CONE PENETROMETER—PRUDHOE BAY, ALASKA.
Blouin, S.E., et al, *Cold regions science and technology,* June 1979, 1(1), p.3-16, 10 refs.
Chamberlain, E.J., Sellmann, P.V., Garfield, D.E.
33-4236
SUBSEA PERMAFROST, PENETRATION TESTS, PERMAFROST DISTRIBUTION, PENETROMETERS, UNITED STATES—ALASKA—PRUDHOE BAY.

MP 1218
RELATIONSHIPS BETWEEN JANUARY TEMPERATURES AND THE WINTER REGIME IN GERMANY.
Bilello, M.A., et al, *Cold regions science and technology,* June 1979, 1(1), p.17-27, 12 refs.
Appel, G.C.
33-4237
WEATHER FORECASTING, FROST FORECASTING, SNOW ACCUMULATION, SEASONAL FREEZE THAW, METEOROLOGICAL DATA, METEOROLOGICAL CHARTS.

MP 1219
WATER FLOW THROUGH HETEROGENEOUS SNOW.
Colbeck, S.C., *Cold regions science and technology,* June 1979, 1(1), p.37-45, 19 refs.
33-4239
MELTWATER, SNOW COVER STRUCTURE, WATER FLOW, SNOW STRATIGRAPHY, CAPILLARITY, SURFACE WATERS.

An earlier gravity flow theory (Colbeck 1971) treated snow as a homogeneous and uniform medium. The theory is expanded here to include the effects of ice layers and flow channels. Two examples are constructed and compared with observed runoff. In this particular situation, the results suggest that most of the water moves down flow channels.

MP 1220
FREEZING AND THAWING TESTS OF LIQUID DEICING CHEMICALS ON SELECTED PAVEMENT MATERIALS.
Minsk, L.D., *Cold regions science and technology,* June 1979, 1(1), p.51-58, 8 refs.
33-4241
CONCRETE PAVEMENTS, ICE REMOVAL, ANTIFREEZES, TESTS.

The extent of deterioration of portland cement concrete and several types of asphaltic concrete subjected to organic deicing chemicals was determined over 60 freezing-thawing cycles. Proprietary solutions containing urea, ethylene glycol, and formamide affected the surface of old air-entrained concrete only slightly (rating of 1 on a scale of 0 to 5 of increasing degradation). Asphaltic concrete specimens were not significantly affected. Abrasion tests were made on air-entrained concrete specimens exposed to ethylene glycol solution during freezing and thawing; material loss was very low, nearly the same as with a distilled water control.

MP 1221
ELECTRICAL GROUND IMPEDANCE MEASUREMENTS IN THE UNITED STATES BETWEEN 200 AND 415 KHZ.
Arcone, S.A., et al, *U.S. Federal Aviation Agency. Research and development report,* Dec. 1978, FAA-RD-78-103, 92p., ADA-068 088.
Delaney, A.J.
33-4413
RADIO WAVES, ELECTRICAL RESISTIVITY, MAPPING.

The objectives of the work described in this report were to use and evaluate new radiowave methods of measuring earth resistivity in the LF and VLF bands and to develop estimated effective ground resistivity maps in this same band for the United States, including Alaska. Both airborne and ground methods were investigated by using the wavetilt and surface impedance techniques. It is concluded from the VLF study that over much of the central United States VLF airborne resistivity might well approximate LF ground resistivity. The ground methods discussion concerns the surface impedance method in the LF band. It is concluded from the LF studies that the present conductivity map is fairly accurate for BCB purposes but inapplicable to LF purposes.

MP 1222
CASE STUDY: FRESH WATER SUPPLY FOR POINT HOPE, ALASKA.
McFadden, T., et al, Conference on Applied Techniques for Cold Environments, Anchorage, Alaska, May 17-19, 1978. Proceedings, Vol.2, New York, American Society of Civil Engineers, 1979, p.1029-1040, 10 refs.
Collins, C.M.
33-4458
WATER SUPPLY, PERMAFROST HYDROLOGY, SNOWMELT, ICE MELTING, LAKE WATER, UNITED STATES—ALASKA—POINT HOPE.

MP 1223
SNOW AND ICE ROADS IN THE ARCTIC.
Johnson, P.R., Conference on Applied Techniques for Cold Environments, Anchorage, Alaska, May 17-19, 1978. Proceedings, Vol.2, New York, American Society of Civil Engineers, 1979, p.1063-1071, 6 refs.
33-4461
SNOW ROADS, ICE ROADS, AIRPORTS, COLD WEATHER CONSTRUCTION, ENVIRONMENTAL PROTECTION, ARCTIC VEGETATION, CONSTRUCTION MATERIALS.

MP 1224
REMOTE DETECTION OF A FRESHWATER POOL OFF THE SAGAVANIRKTOK RIVER DELTA, ALASKA.
Kovacs, A., et al, *Arctic,* June 1979, 32(2), p.161-164, 4 refs.
Morey, R.M.
33-4511
RADAR ECHOES, GROUND ICE, GROUND WATER.

MP 1225
EFFECT OF FREEZING AND THAWING ON THE PERMEABILITY AND STRUCTURE OF SOIL.
Chamberlain, E.J., et al, *Engineering geology,* 1979, Vol.13, p.73-92, For another version and abstract see 32-3469. 11 refs.
Gow, A.J.
33-4548
FREEZE THAW CYCLES, SOIL WATER MIGRATION, PERMEABILITY, SOIL STRUCTURE, SOIL PHYSICS, SOIL TEXTURE, PARTICLE SIZE DISTRIBUTION, FINES.

MP 1226
EFFECT OF FREEZE-THAW CYCLES ON RESILIENT PROPERTIES OF FINE-GRAINED SOILS.
Johnson, T.C., et al, *Engineering geology,* 1979, Vol.13, p.247-276, For another version and abstract see 32-3502. 20 refs.
Cole, D.M., Chamberlain, E.J.
33-4549
FROZEN GROUND MECHANICS, FREEZE THAW CYCLES, PAVEMENT BASES, BEARING TESTS, SHEAR STRESS, SUBGRADE SOILS, LOADS (FORCES), SOIL TEMPERATURE, MODELS.

MP 1227
THERMAL AND RHEOLOGICAL COMPUTATIONS FOR ARTIFICIALLY FROZEN GROUND CONSTRUCTION.
Sanger, F.J., et al, *Engineering geology,* 1979, Vol.13, p.311-337, 32 refs. For another version and abstract see 33-4283.
Sayles, F.H.
33-4550
SOIL FREEZING, ARTIFICIAL FREEZING, FROZEN GROUND MECHANICS, FROZEN GROUND THERMODYNAMICS, CREEP PROPERTIES, RHEOLOGY, THERMAL PROPERTIES, FROST HEAVE, ANALYSIS (MATHEMATICS), CONSTRUCTION.

MP 1228
LAND APPLICATION OF WASTEWATER: EFFECT ON SOIL AND PLANT POTASSIUM.
Palazzo, A.J., et al, *Journal of environmental quality,* July-Sep. 1979, 8(3), p.309-312, 19 refs.
Jenkins, T.F.
33-4584
WASTE TREATMENT, WASTE DISPOSAL, GRASSES, SOIL CHEMISTRY, IRRIGATION.

MP 1229

MULTI YEAR PRESSURE RIDGES IN THE CANADIAN BEAUFORT SEA.

Wright, B., et al, International Conference on Port and Ocean Engineering Under Arctic Conditions, 5th, Trondheim, Norway, Aug. 13-18, 1979. Proceedings, Vol.1, Trondheim, University, 1979, p.107-126, 17 refs.

Hnatiuk, J., Kovacs, A.

33-4609

SEA ICE, PRESSURE RIDGES, ICE STRUCTURE, MODELS.

The findings of a field study designed to generate fundamental data on multi-year pressure ridges in the near shore zone of the Canadian Beaufort Sea are presented. The study investigated the geometry of eleven floating multi-year ridges or ridge fragments and the sail height and keel depth of four additional multi-year ridge fragments. The cross-sections of multi-year ridges with total thicknesses varying between 9.6 and 41.8 m were examined, and the results suggest that they can be adequately represented by one ridge model with a constant sail to keel ratio and geometry. It is also shown that the ice comprising multi-year ridges is solid with the interblock voids existing at the time of their formation being completely filled with ice. The data obtained from this study are being used in the engineering design of exploration and production systems for the Beaufort Sea. In the shallow waters of this area, exploratory drilling from artificial islands has been carried out since 1973, and since 1976, the exploration effort has extended into the deeper waters of the Beaufort Sea, using drillships.

MP 1230

ICE PILE-UP AND RIDE-UP ON ARCTIC AND SUBARCTIC BEACHES.

Kovacs, A., et al, International Conference on Port and Ocean Engineering Under Arctic Conditions, 5th, Trondheim, Norway, Aug. 13-18, 1979. Proceedings, Vol.1, Trondheim, University, 1979, p.127-146, 22 refs.

Sodhi, D.S.

33-4610

SEA ICE, SHORES, PRESSURE RIDGES, ICE PUSH.

Information on shore ice pile-up and ride-up in arctic and subarctic waters is presented. Cross-sectional profiles of several ice pile-ups and ride-ups are presented from which models and theoretical analyses were made. The expressions derived give the force required to overcome gravitational potential and friction occurring during ice-piling and ride-up. It was estimated that the distributed force required during ice-piling or ride-up was of the order of 10 to 350 kPa (about 1.5 to 50 psi). Field observations revealed that shore ice pile-up or ride-up appears to occur within a period of less than 30 minutes at any time of year, but most often in the spring and fall. Pile-up seldom occurs more than 10 m inland from the sea, but ride-up frequently extends 50 m or more inland, regardless of ice thickness. While steeply sloping shores do not favor ice ride-up, sea ice has mounted the steep, 9-m-high bluff at Barrow, Alaska, destroying structures and taking lives.

MP 1231

TEMPERATURE EFFECT ON THE UNIAXIAL STRENGTH OF ICE.

Haynes, F.D., International Conference on Port and Ocean Engineering Under Arctic Conditions, 5th, Trondheim, Norway, Aug. 13-18, 1979. Proceedings, Vol.1, Trondheim, University, 1979, p.667-681, 17 refs.

33-4632

ICE STRENGTH, COMPRESSIVE STRENGTH, TENSILE PROPERTIES.

The effect of temperature on the uniaxial strength of fine-grained, polycrystalline ice was investigated. Dumbbell-shaped specimens were loaded in uniaxial compression and uniaxial tension. Two machine speeds, 0.847 mm/s and 84.7 mm/s, were used for the tests, and the test temperatures ranged from -0.1 to -54C. The uniaxial compressive strength is very sensitive to temperature, generally increasing as the temperature decreased from -0.1C to -54C, with the greatest increase between -0.1C and -3C. The tensile strength is not very sensitive to temperature, but did continue to increase with decreasing temperature. Tensile strength also increased the most between -0.1C and -3C. An initial tangent modulus and a 50% stress modulus were found for each compression test. The initial tangent modulus increased about two times as the temperature decreased from -0.1C to -54C. The 50% stress modulus also increased with decreasing temperature. A secant modulus was found for the tensile tests and it tended to decrease with decreasing temperature. The specific energy required to cause failure was also found for the compression and tension tests.

MP 1232

BUCKLING ANALYSIS OF WEDGE-SHAPED FLOATING ICE SHEETS.

Sodhi, D.S., International Conference on Port and Ocean Engineering Under Arctic Conditions, 5th, Trondheim, Norway, Aug. 13-18, 1979. Proceedings, Vol.1, Trondheim, University, 1979, p.797-810, 7 refs.

33-4641

SEA ICE, FLOATING ICE, ICE LOADS, ICE PRESSURE.

A buckling analysis for semi-infinite wedge-shaped floating ice sheets is presented, considering a radial stress field for the in-plane stresses. The buckling load and buckling pressure are computed for varying ice sheet geometry and boundary conditions. The results of this analysis are close to those of earlier analyses for semi-infinite ice sheets and tapered beams.

MP 1233

SNOW ACCUMULATION, DISTRIBUTION, MELT, AND RUNOFF.

Colbeck, S.C., et al, *American Geophysical Union. Transactions,* May 22, 1979, 60(21), p.465-468, 29 refs.

33-4547

SNOW ACCUMULATION, SNOW COVER DISTRIBUTION, SNOWMELT, RUNOFF, HEAT TRANSFER, SNOW SURVEYS, REMOTE SENSING, HYDROLOGY.

MP 1234

COMPACTION OF WET SNOW ON HIGHWAYS.

Colbeck, S.C., *National Research Council. Transportation Research Board. Special report,* 1979, No.185, International Symposium on Snow Removal and Ice Control Research, 2nd, Hanover, N.H., May 15-19, 1978. Proceedings, p.14-17, 7 refs.

34-52

WET SNOW, SNOW COMPACTION, SNOW REMOVAL, SALINITY.

The compressibility of wet snow decreases with decreasing liquid water content but increases with decreasing salinity. Also, the tendency for snow splashing on highways increases with decreasing salinity. These opposite effects are complicated by the fact that liquid water content and salinity are not necessarily independent. The amount of liquid present can be controlled somewhat by the road grade, and salinity is generally determined by how much salt is applied to the road surface. For different situations it may be desirable to regulate salt applications in order to achieve a maximum amount of splashing with a minimum of compaction of wet snow into ice. Here we provide a qualitative review of wet snow and suggest how an understanding of wet snow's behavior on a road surface might increase our ability to deal with snow removal problems.

MP 1235

NUMERICAL SIMULATION OF ATMOSPHERIC ICE ACCRETION.

Ackley, S.F., et al, *National Research Council. Transportation Research Board. Special report,* 1979, No.185, International Symposium on Snow Removal and Ice Control Research, 2nd, Hanover, N.H., May 15-19, 1978. Proceedings, p.44-52, 7 refs.

Templeton, M.K.

34-57

ICE ACCRETION, MATHEMATICAL MODELS, ENVIRONMENT SIMULATION, DROPS (LIQUIDS), PARTICLE SIZE DISTRIBUTION, TIME FACTOR.

Time-dependence enters into calculations of ice accretion on objects primarily through terms dependent on the initial conditions and size and geometry of the object. A numerical technique to include the time-dependence is described here as well as simulation of complex situations where the conditions vary, for example, along a helicopter rotor blade. Some results of varying droplet sizes, velocity, and droplet distributions are presented. These indicate the general dependence of ice accretion on these parameters as well as illustrate the utility of numerical techniques in seeing how these effects can influence the rates of ice accretion for particular initial conditions.

MP 1236

LABORATORY EXPERIMENTS ON ICING OF ROTATING BLADES.

Ackley, S.F., et al, *National Research Council. Transportation Research Board. Special report,* 1979, No.185, International Symposium on Snow Removal and Ice Control Research, 2nd, Hanover, N.H., May 15-19, 1978. Proceedings, p.85-92, 7 refs.

Lemieux, G., Itagaki, K., O'Keefe, J.

34-65

LABORATORY TECHNIQUES, ICE ACCRETION, HELICOPTERS, ICE COVER THICKNESS, TEMPERATURE EFFECTS.

Experiments have been conducted to provide a basis for a computer model that simulates atmospheric ice accretion on a rotating blade. A comparison of the computer model simulation and experimental results reveals that general agreement exists within the temperature range 0 C to -25 C and the velocity range 0 to 60 m/s. Beyond 60 m/s the computer simulation over-predicts the thickness of the ice accretion at the leading edge. Below -25 C the simulation and experimental results disagree in that the simulation significantly overpredicts the thickness of the accretion at the leading edge.

MP 1237

SYSTEMS STUDY OF SNOW REMOVAL.

Minsk, L.D., *National Research Council. Transportation Research Board. Special report,* 1979, No.185, International Symposium on Snow Removal and Ice Control Research, 2nd, Hanover, N.H., May 15-19, 1978. Proceedings, p.220-225, 4 refs.

34-84

SNOW REMOVAL, SYSTEMS ANALYSIS.

The framework for a systems analysis of snow removal and ice control on roads is presented. Definition of the operating conditions, the principal ones of which are climate and traffic, as well as the system itself, the road net, is required. Equipment factors involved in performing the basic functions of clearing, spreading, loading, and hauling are analyzed.

MP 1238

COMPUTER SIMULATION OF URBAN SNOW REMOVAL.

Tucker, W.B., et al, *National Research Council. Transportation Research Board. Special report,* 1979, No.185, International Symposium on Snow Removal and Ice Control Research, 2nd, Hanover, N.H., May 15-19, 1978. Proceedings, p.293-302, 11 refs.

Clohan, G.M.

34-95

SNOW REMOVAL, COMPUTERIZED SIMULATION, ENVIRONMENT SIMULATION.

A general computer model to simulate urban snow removal has been developed. One part of the package includes several programs which assist in the routing of snow removal vehicles using computer graphics. The primary element, however, is a program which, once specific vehicle routes are input, allows the simulation of any particular snow removal scenario. Parameters that can be varied include both truck and snowstorm characteristics. This simulation program is tested using truck routes and storm data from Newington, Connecticut. Results indicate that the simulation predicts plowing times quite reasonably.

MP 1239

ULTRASONIC VELOCITY INVESTIGATIONS OF CRYSTAL ANISOTROPY IN DEEP ICE CORES FROM ANTARCTICA.

Kohnen, H., et al, *Journal of geophysical research,* Aug. 20, 1979, 84(C8), p.4865-4874, 22 refs.

Gow, A.J.

34-410

ICE CORES, ICE CRYSTAL STRUCTURE, ICE ACOUSTICS, ICE SHEETS, ANISOTROPY, WAVE PROPAGATION, ULTRASONIC TESTS, GLACIER FLOW, ICE CRYSTAL SIZE, SHEAR PROPERTIES, ANTARCTICA—BYRD STATION, ANTARCTICA—LITTLE AMERICA STATION.

For the same paper from another source and abstract see 33-4204 or F-21944.

MP 1240

SEA ICE RIDGING OVER THE ALASKAN CONTINENTAL SHELF.

Tucker, W.B., et al, *Journal of geophysical research,* Aug. 20, 1979, 84(C8), p.4885-4897, 24 refs. For the same paper from another source and abstract see 33-4223.

Weeks, W.F., Frank, M.

34-411

SEA ICE DISTRIBUTION, PRESSURE RIDGES, ICE DEFORMATION, SURFACE ROUGHNESS, PROFILES, LASERS, MATHEMATICAL MODELS, STATISTICAL ANALYSIS, REMOTE SENSING, FORECASTING.

MP 1241

SOME RESULTS FROM A LINEAR-VISCOUS MODEL OF THE ARCTIC ICE COVER.

Hibler, W.D., III, et al, *Journal of glaciology,* 1979, 22(87), p.293-304, 12 refs.

Tucker, W.B.

34-544

ICE PHYSICS, DRIFT STATIONS, ICE MODELS, SEA ICE, VISCOSITY, OCEAN CURRENTS, STRESSES.

MP 1242

STANDING CROP OF ALGAE IN THE SEA ICE OF THE WEDDELL SEA REGION.

Ackley, S.F., et al, *Deep-sea research,* Mar. 1979, 26(3A), p.269-281, 19 refs.

Buck, K.R., Taguchi, S.

33-4674

SEA ICE, ALGAE, CRYOBIOLOGY, WEDDELL SEA.

Physical and biological measurements were made of sea ice cores taken from 69 to 78 S in the Weddell Sea. Fluorescence measurements indicated an algal community that was strongly associated with salinity maxima within the ice. Maximum concentrations of chlorophyll *a* ranged from 0.31 to 4.54 mg cu m. Comparisons with standing crops in the water column indicate that the standing crop within the ice can represent a minor but significant fraction of the total standing crop for the region. The sea ice algal community is apparently distinct from others that have been described for land-fast ice in McMurdo Sound, sea ice in the Arctic, and pack ice off East Antarctica. The highest concentrations of biological material are found in the bottom or top samples from those regions, whereas the Weddell Sea maxima are concentrated at intermediate depths (0.65 to 2.15m) within the ice. A qualitative model indicating the relationship between thermally induced brine migration and subsequent algal growth is presented. (Auth. mod.)

MP 1243

FORMATION OF ICE RIPPLES ON THE UNDERSIDE OF RIVER ICE COVERS.

Ashton, G.D., Iowa City, University of Iowa, 1971, 157p., University Microfilms order No.71-30,392, Ph.D. thesis. For abstract see Dissertation abstracts international, Sec. B, Nov. 1971, p.2762.

34-600

RIVER ICE, ICE BOTTOM SURFACE, ICE WATER INTERFACE, TURBULENT FLOW, HEAT TRANSFER, THERMAL CONDUCTIVITY, WATER FLOW, VELOCITY.

MP 1244

RESEARCH ACTIVITIES OF U.S. ARMY COLD REGIONS RESEARCH AND ENGINEERING LABORATORY.

Buzzell, T.D., *Alaska. University. Institute of Water Resources. Report,* Mar. 1975, IWR-62, Environmental Standards for Northern Regions: a symposium, June 1974, Anchorage, Alaska. p.9-12.

34-631

LABORATORIES, RESEARCH PROJECTS.

MP 1245

20-YR CYCLE IN GREENLAND ICE CORE RECORDS.

Hibler, W.D., III, et al, *Nature,* Aug. 9, 1979, 280(5722), p.481-483, 26 refs.

Johnsen, S.J.

34-737

ICE CORES, DRILL CORE ANALYSIS, ISOTOPE ANALYSIS, PERIODIC VARIATIONS.

Oxygen isotope analysis of Greenland ice cores is made and the methods of analysis are described. Cyclic variations of about 20 yr seem to coincide with climatic oscillations and the Sun's motion about the center of mass of the Solar System. These periodic variations are compared with the oxygen isotope record in the ice cores.

MP 1246

PHENOMENOLOGICAL DESCRIPTION OF THE ACOUSTIC EMISSION RESPONSE IN SEVERAL POLYCRYSTALLINE MATERIALS.

St. Lawrence, W.F., *Journal of testing and evaluation,* July 1979, 7(4), p.223-228, 11 refs.

34-747

SNOW DEFORMATION, SNOW COVER STRUCTURE, SNOW ACOUSTICS, ACOUSTIC MEASUREMENT, MODELS.

The pattern of acoustic emission response in snow subjected to constant deformation rates is examined. The structural character of snow is discussed, and an equation that describes the pattern of the acoustic emission response is derived. Comparison between the predicted acoustic response and experimental data is made and the agreement is shown to be excellent. The acoustic emission response for 7075-T6 aluminum and iron-3% silicon subjected to constant rates of deformation is also considered. The acoustic emission equation derived for snow represents the response in these materials. It is suggested that the internal fracture concept used to develop the model for snow may also apply to other densely packed polycrystalline materials.

MP 1247

DYNAMIC THERMODYNAMIC SEA ICE MODEL.

Hibler, W.D., III, *Journal of physical oceanography,* July 1979, 9(4), p.815-846, 51 refs.

34-741

SEA ICE, THERMODYNAMICS, HEAT TRANSFER, ICE COVER THICKNESS, MATHEMATICAL MODELS.

A numerical model for the simulation of sea ice circulation and thickness over a seasonal cycle is presented. This model is used to investigate the effects of ice dynamics on arctic ice thickness and air-sea heat flux characteristics by carrying out several numerical simulations over the entire Arctic Ocean region. The essential idea in the model is to couple the dynamics to the ice thickness characteristics by allowing the ice interaction to become stronger as the ice becomes thicker and/or contains a lower areal percentage of thin ice. The dynamics, in turn, causes high oceanic heat losses in regions of ice divergence and reduced heat losses in regions of convergence. To model these effects consistently, the ice is considered to interact in a plastic manner with the plastic strength chosen to depend on the ice thickness and concentration. The thickness and concentration, in turn, evolve according to continuity equations which include changes in ice mass and percent of open water due to advection, ice deformation and thermodynamic effects.

MP 1248

STEADY IN-PLANE DEFORMATION OF NONCOAXIAL PLASTIC SOIL.

Takagi, S., *International journal of engineering science,* 1979, Vol.17, p.1049-1072, 27 refs.

34-860

SOIL CREEP, PLASTIC PROPERTIES, THEORIES, BOUNDARY VALUE PROBLEMS, ANALYSIS (MATHEMATICS).

Presented in this paper is the theory of the steady in-plane deformation, obeying the Coulomb yield criterion, of plastic soils whose strain rate and stress principal directions are noncoaxial. The constitutive equations including an unknown noncoaxial angle are derived by use of the geometry of the Mohr circle and the theory of characteristic lines. A boundary value problem is solved by assigning to the non coaxial angle a set of such values that enable us to accommodate the presupposed type of flow satisfying the given boundary conditions in a given domain. The plastic material regulated by the Coulomb yield criterion in in-plane deformation is, therefore, a singular material whose constitutive equations are not constant with material but are variable with flow conditions.

MP 1249

SAFE ICE LOADS COMPUTED WITH A POCKET CALCULATOR.

Nevel, D.E., *National Research Council, Canada. Associate Committee on Geotechnical Research. Technical memorandum,* May 1979, No.123, p.205-223, 3 refs.

34-932

ICE STRENGTH, LOADS (FORCES), COMPUTER APPLICATIONS.

This report provides a program for calculating the deflection and stresses of a floating ice sheet using a pocket calculator. The program user must select appropriate values for the ice mechanical properties in order to compute reliable deflection and stresses. Engineering judgement must be used to select the allowable ice strength and when dealing with non-ideal situations.

MP 1250

PROBLEMS OF OFFSHORE OIL DRILLING IN THE BEAUFORT SEA.

Weller, G., et al, *Northern engineer,* Winter 1978, 10(4), p.4-11, 5 refs.

Weeks, W.F.

34-942

ICE STRUCTURE, OFFSHORE DRILLING, FLOATING ICE, GROUNDED ICE, SEA ICE DISTRIBUTION, SUBSEA PERMAFROST.

MP 1251

COLD REGIONS RESEARCH AND ENGINEERING LABORATORY.

Freitag, D.R., *Northern engineer,* Fall 1977, 10(3), p.4-6.

34-869

LABORATORIES, U.S. ARMY CRREL.

MP 1252

RECENT ICE OBSERVATIONS IN THE ALASKAN BEAUFORT SEA FEDERAL-STATE LEASE AREA.

Kovacs, A., *Northern engineer,* Fall 1978, 10(3), p.7-12.

34-870

SEA ICE, FAST ICE, RADAR ECHOES, PRESSURE RIDGES, SEISMIC SURVEYS.

MP 1253

DESIGN AND CONSTRUCTION OF TEMPORARY AIRFIELDS IN THE NATIONAL PETROLEUM RESERVE—ALASKA.

Crory, F.E., *Northern engineer,* Fall 1978, 10(3), p.13-15, 1 ref.

34-871

AIRCRAFT LANDING AREAS, SUBGRADE PREPARATION, INSULATION.

MP 1254

HUMAN-INDUCED THERMOKARST AT OLD DRILL SITES IN NORTHERN ALASKA.

Lawson, D.E., et al, *Northern engineer,* Fall 1978, 10(3), p.16-23, 16 refs.

Brown, J.

34-872

TUNDRA, SOIL EROSION, THERMOKARST, HUMAN FACTORS, ACTIVE LAYER, SUBSIDENCE.

MP 1255

OVERCONSOLIDATED SEDIMENTS IN THE BEAUFORT SEA.

Chamberlain, E.J., *Northern engineer,* Fall 1978, 10(3), p.24-29, 15 refs.

34-873

BOTTOM SEDIMENT, THAW CONSOLIDATION, CLAY SOILS, FREEZE THAW CYCLES.

MP 1256

WASTE HEAT RECOVERY FOR HEATING PURPOSES.

Phetteplace, G., *Northern engineer,* Fall 1978, 10(3), p.30-33.

34-874

HEAT RECOVERY, HEATING, PUMPS.

MP 1257

MIZEX 84 MESOSCALE SEA ICE DYNAMICS: POST OPERATIONS REPORT.

Hibler, W.D., III, et al, *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* Oct. 1984, SR 84-29, MIZEX: a program for mesoscale air-ice-ocean interaction experiments in Arctic marginal ice zones. 5: MIZEX 84 summer experiment PI preliminary reports. Edited by O.M. Johannessen and D.A. Horn, p.66-69, ADA-148 986.

Leppäranta, M., Decato, S., Alverson, K.

40-4695

ICE MECHANICS, SEA ICE, ICE CONDITIONS, DRIFT STATIONS, ICE EDGE, MEASURING INSTRUMENTS.

MP 1258

ANISOTROPIC PROPERTIES OF SEA ICE IN THE 50- TO 150-MHZ RANGE.

Kovacs, A., et al, *Journal of geophysical research,* Sep. 20, 1979, 84(C9), p.5749-5759, 4 refs.

Morey, R.M.

34-963

SEA ICE, RADAR ECHOES, ICE CRYSTAL STRUCTURE, OCEAN CURRENTS, DIELECTRIC PROPERTIES, ANISOTROPY.

Results of impulse radar studies of sea ice near Prudhoe Bay, Alaska, show that where there is a preferred current direction under the ice cover, the crystal structure of the ice becomes highly ordered. This includes a crystal structure with a preferred horizontal *c* axis that is oriented parallel with the local current. The radar studies show that this structure behaves as an anisotropic dielectric. The result is that when electromagnetic energy is radiated from a dipole antenna in which the *E* field is oriented perpendicular to the *c* axis azimuth, no bottom reflection is detected. It was also found that the frequency dispersion of anisotropic sea ice varies in the horizontal plane. This is demonstrated by the center frequency of the reflected signal spectrum, which is maximum in the preferred *c* axis direction and minimum perpendicular to it. In addition, it was found that the frequency dispersion is related to the average bulk brine volume of the ice but that the bulk dielectric constant of the ice, as determined from impulse travel time, shows little correlation with the coefficient of anisotropy.

MP 1259

ANALYSIS OF COUPLED HEAT AND MOISTURE FLOW IN AN UNSATURATED SOIL.

O'Neill, K., *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* Jan. 1979, SR 79-36, Meeting on Modeling of Snow Cover Runoff, 26-28 September 1978, Hanover, New Hampshire. Proceedings, edited by S.C. Colbeck and M. Ray, p.304-309, ADA-167 767, 25 refs.

34-1027

SOIL WATER MIGRATION, HEAT TRANSFER.

This paper presents a set of partial differential equations that describes the concurrent one-dimensional flow of liquid and heat in unfrozen unsaturated soils. A Galerkin finite element method based on hermite polynomials was used to solve the equations numerically. To verify both the theory and the solution method, laboratory measurements were made on a horizontal soil column. The results furnished essential transport coefficient values, as well as data records over space and time for infiltrations of cold water that produced steep, interacting temperature and moisture content gradients. Comparison of measured and predicted values showed very good agreement in both the moisture and temperature domains. Contrary to the usual assumption in soil studies, liquid convection played a large role in the heat transfer. A simple geometric mean formula represented the soil thermal conductivity quite adequately.

MP 1260

SURFACE-BASED SCATTEROMETER RESULTS OF ARCTIC SEA ICE.

Onstott, R.G., et al, *IEEE transactions of geoscience electronics,* July 1979, GE-17(3), p.78-85, 16 refs.

Moore, R.K., Weeks, W.F.

34-1167

SEA ICE, RADAR ECHOES, BACKSCATTERING, PRESSURE RIDGES, ICE COVER THICKNESS.

Radar backscatter measurements were made of shorefast sea ice near Point Barrow, AK, in May 1977, with a surface-based FM-CW scatterometer that swept from 1-2 GHz and from 8.5-17.5 GHz. The 1-2 GHz measurements showed that thick first-year and multiyear ice cannot be distinguished at 10-70 deg incidence angles but that undeformed sea ice can be discriminated from pressure ridges and lake ice. Results also indicate that frequencies between 8-18 GHz have the ability to discriminate between thick first-year, multiyear, and lake ice. Cross polarization was found to be a better discriminator than like polarization. In addition, at these latter frequencies the differential scattering was found to have an approximately linearly increasing frequency response.

MP 1261
FOCUS ON U.S. SNOW RESEARCH.

Colbeck, S.C., *Glaciological data,* Aug. 1979, GD-6, p.41-52, 34 refs.
34-1411
SNOW SURVEYS, RESEARCH PROJECTS, IMPACT, AGRICULTURE, WATER RESERVES.

MP 1262
SNOW AND THE ORGANIZATION OF SNOW RESEARCH IN THE UNITED STATES.

Colbeck, S.C., *Glaciological data,* Aug. 1979, GD-6, p.55-58, 1 ref.
34-1412
SNOW SURVEYS, RESEARCH PROJECTS.

MP 1263
VISUAL OBSERVATIONS OF FLOATING ICE FROM SKYLAB.

Campbell, W.J., et al, *U.S. National Aeronautics and Space Administration. Special publication,* 1977, NASA-SP-380, Skylab explores the earth, prepared by NASA Lyndon B. Johnson Space Center, p.353-379, N77-28548, 2 refs.
Ramseier, R.O., Weeks, W.F., Wayneberg, J.A.
34-1493
SPACEBORNE PHOTOGRAPHY, LAKE ICE, SEA ICE, RIVER ICE.

MP 1264
ANALYSIS OF FLEXIBLE PAVEMENT RESILIENT SURFACE DEFORMATIONS USING THE CHEVRON LAYERED ELASTIC ANALYSIS COMPUTER PROGRAM.

Smith, N., et al, 1975, 13 leaves, Presented at the Symposium on Nondestructive Test and Evaluation of Airport Pavement, U.S. Army Waterways Experiment Station, [Vicksburg, Mississippi], November 18-20, 1975. 9 refs.
Groves, J.A.
34-1501
PAVEMENTS, ELASTIC PROPERTIES, COMPUTER APPLICATIONS.

MP 1265
NONCORROSIVE METHODS OF ICE CONTROL.

Minsk, L.D., Public works and public utilities: report from a workshop considering problems identified by the Intergovernmental Science, Engineering, and Technology Advisory Panel, September 5-7, 1979, College Park, Maryland, Washington, D.C., American Association for the Advancement of Science, 1979, p.133-162, 33 refs.
34-1586
ROADS, ICE CONTROL, CHEMICAL ICE PREVENTION, ENVIRONMENTAL IMPACT, SALTING.

MP 1266
GEOPHYSICS IN THE STUDY OF PERMAFROST.

Scott, W.J., et al, International Conference on Permafrost, 3rd, Edmonton, Alberta, July 10-13, 1978. Proceedings, Vol.2, Ottawa, National Research Council of Canada, 1979, p.93-115, Refs. p.110-115.
Sellmann, P.V., Hunter, J.A.
34-1682
PERMAFROST PHYSICS, GEOPHYSICAL SURVEYS, SEISMIC SURVEYS, SOIL TEMPERATURE, ELECTRICAL RESISTIVITY, ACTIVE LAYER, ELECTROMAGNETIC PROSPECTING.

MP 1267
GRAIN CLUSTERS IN WET SNOW.

Colbeck, S.C., *Journal of colloid and interface science,* Dec. 1979, 72(3), p.371-384, 19 refs.
34-1698
WET SNOW, SNOW CRYSTAL STRUCTURE, GRAIN SIZE, BOUNDARY VALUE PROBLEMS, SNOW PHYSICS.

The grain boundaries in snow are generally unstable when the pore space is filled with liquid water (i.e., liquid-saturated snow). Thus, when unstressed snow is saturated with the melt, the ice particles in snow are cohesionless spheres. This leads to very low strengths and to rapid grain growth due to heat flow among particles of different sizes. The grain boundaries in highly unsaturated snow (up to about 7% liquid by volume) with small applied loads are stable, and the grains must be arranged in clusters to achieve local force equilibrium. Two grains bond together with geometrical constraints on the radii of the phase boundaries. Three grains join at a liquid vein whose size is determined by grain size and capillary pressure (i.e., liquid "tension"). Slow grain growth occurs by sublimation, vapor diffusion, and condensation, and intergrain strength is relatively high. Once grain clusters are formed, equilibrium imposes constraints on the curvature of the phase boundaries which limit change in the capillary pressure.

MP 1268
FEASIBILITY STUDY OF LAND TREATMENT OF WASTEWATER AT A SUBARCTIC ALASKAN LOCATION.

Sletten, R.S., et al, Cornell Agricultural Waste Management Conference, 8th, Rochester, N.Y., 1976. Proceedings. Land as a waste management alternative, edited by R.C. Loehr, Ann Arbor, Mich., Ann Arbor Science, 1977, p.533-547, For another version see 31-1949. 10 refs.
Uiga, A.
34-1749
WASTE TREATMENT, WATER POLLUTION, LAND RECLAMATION, SUBPOLAR REGIONS, SUBARCTIC LANDSCAPES, TESTS, UNITED STATES—ALASKA.

MP 1269
APPLICATION OF RECENT RESULTS IN FUNCTIONAL ANALYSIS TO THE PROBLEM OF WATER TABLES.

Nakano, Y., *Advances in water resources,* Dec. 1979, Vol.2, p.185-190, 7 refs.
34-1845
WATER TABLE, BOUNDARY VALUE PROBLEMS, ANALYSIS (MATHEMATICS).

The traditional viewpoint in hydrology and soil physics purports that water tables appearing in porous media described by Darcy's law and the extended Darcy's law are not singular surfaces. Several particular solutions in which singularities occur are presented as counter-examples to the traditional viewpoint and as evidence supporting the new theory that water tables are generally singular surfaces.

MP 1270
INCREASED MERCURY CONTAMINATION OF DISTILLED AND NATURAL WATER SAMPLES CAUSED BY OXIDIZING PRESERVATIVES.

Cragin, J.H., Analytica chimica acta, 1979, Vol.110, p.313-319, 18 refs.
34-2004
WATER CHEMISTRY, GASES, VAPOR TRANSFER, POLLUTION, LABORATORIES.

The passage of mercury vapor from ambient air through the walls of conventional polyethylene (CPE), linear polyethylene (LPE), and Teflon (FEP) containers can seriously contaminate solutions of distilled and natural water stored in these containers. The rate of mercury contamination is dramatically increased when the sample solution contains oxidizing agents such as nitric acid or potassium permanganate, which are commonly used as preservatives to prevent loss of mercury (II) ion. The rate of contamination also depends on container material and decreases in the order CPE> LPE> FEP> glass. Freezing the samples in plastic containers is an effective way to prevent mercury contamination. When freezing is not practical, storage in glass containers minimizes sample contamination from ambient mercury vapor.

MP 1271
CORRELATION AND QUANTIFICATION OF AIRBORNE SPECTROMETER DATA TO TURBIDITY MEASUREMENTS AT LAKE POWELL, UTAH.

Merry, C.J., International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Michigan, April 23-27, 1979. Proceedings, Environmental Research Institute of Michigan, 1979, p.1309-1316, 7 refs.
34-2043
LAKE WATER, TURBIDITY, SUSPENDED SEDIMENTS, LIGHT TRANSMISSION, AERIAL SURVEYS, SPECTROSCOPY.

A water sampling program was accomplished at Lake Powell, Utah, during June 1975 for correlation to multispectral data obtained with a 500-channel airborne spectroradiometer. Field measurements were taken of percentage of light transmittance, surface temperature, pH and Secchi disk depth. Percentage of light transmittance was also measured in the laboratory for the water samples. Analyses of electron micrographs and suspended sediment concentration data for four water samples located at Hite Bridge, Mile 168, Mile 150 and Bullfrog Bay indicated differences in the composition and concentration of the particulate matter. Airborne spectroradiometer multispectral data were analyzed for the four sampling locations. The results showed that: (a) as the percentage of light transmittance of the water samples decreased, the reflected radiance increased; and (b) as the suspended sediment concentration (mg/1) increased, the reflected radiance increased in the 1-80 mg/1 range. In conclusion, valuable qualitative information was obtained on surface turbidity for the Lake Powell water spectra. Also, the reflected radiance measured at a wavelength of 0.58 micron was directly correlated to the suspended sediment concentration.

MP 1272
ON THE ORIGIN OF STRATIFIED DEBRIS IN ICE CORES FROM THE BOTTOM OF THE ANTARCTIC ICE SHEET.

Gow, A.J., et al, *Journal of glaciology,* 1979, 23(89), p.185-192, In English with French and German summaries. 11 refs.
Epstein, S., Sheehy, W.
34-2231
ICE CORES, DRILL CORE ANALYSIS, SEDIMENTATION, STRATIFICATION, FREEZE THAW CYCLES.

Cores from the bottom 4.83 m of the antarctic ice sheet at Byrd Station contain abundant stratified debris ranging from silt-sized particles to cobbles. The nature and disposition of the debris, together with measurements of the physical properties of the inclosing ice, indicate that this zone of dirt-laden ice originated by "freezing-in" at the base of the ice sheet. The transition from air-rich glacial ice to ice practically devoid of air coincided precisely with the first appearance of debris in the ice at 4.83 m above the bed. Stable-isotope studies made in conjunction with gas-content measurements also confirm the idea of incorporation of basal ice may well constitute the most diagnostic test for discriminating between debris incorporated in a melt-refreeze process and debris entrapped by purely mechanical means, e.g. shearing. We conclude from our observations on bottom cores from Byrd Station that "freezing-in" of basal debris is the major mechanism by which sediment is incorporated into polar ice sheets. (Auth.)

MP 1273
SUBARCTIC WATERSHED RESEARCH IN THE SOVIET UNION.

Slaughter, C.W., et al, *Arctic bulletin,* 1978, 2(13), p.305-313, For another version of this report see 32-1318 (CRREL SR 77-15). 6 refs.
Bilello, M.A.
34-2390
WATER BALANCE, STATIONS, RESEARCH PROJECTS, INTERNATIONAL COOPERATION, USSR—MAGADAN.

MP 1274
DRAINAGE NETWORK ANALYSIS OF A SUBARCTIC WATERSHED.

Bredthauer, S.R., et al, *Alaska. University. Sea Grant Program. Report,* Aug. 1979, 79-6, Alaska Science Conference, 29th, Fairbanks, Aug. 15-17, 1979. Proceedings (Alaska fisheries: 200 years and 200 miles of change), edited by B.R. Melteff, p.349-359, 8 refs.
Hoch, D.
34-2434
WATERSHEDS, DRAINAGE, STREAM FLOW.

A drainage network map of the Caribou-Poker Creek Research Watershed, near Fairbanks, Alaska, has been used to conduct a Strahler stream order analysis and an analysis of length distributions of source and tributary-source links in a subarctic watershed. The basins have very low drainage densities, ranging from 1.35 km/sq km to 5.34 km/sq km. Bifurcation ratios were higher than those found in watersheds in the continental U.S. Statistical analysis indicates that source and tributary-source links in a subarctic watershed belong to different length populations, the same as found in other regions of the world. Additional analysis indicates that exterior links originating on permafrost slopes tend to be shorter than those originating on non-permafrost (well-drained) slopes.

MP 1275
HIGH-FORCE TOWING.

Mellor, M., *Cold regions science and technology,* Feb. 1980, 1(3/4), p.231-240, 5 refs.
34-2445
ICEBERG TOWING, LOADS (FORCES).

Required force levels for iceberg towing at 1 knot could be at least 50 tons for protection of structures and drillships in northern waters, and around 1000 tons for iceberg exports from the Antarctic. Corresponding values of effective ("towrope") power are only 307 hp and 6140 hp, respectively. A conventional-hull supertug capable of 1000 tons thrust would probably have T/P=10 lbf/hp, p=200,000 hp, and a propulsive efficiency of about 3%. The most practical expedient for antarctic towing seems to be use of multiple conventional tugs, with fewer tugs or higher speeds as the iceberg reduces its size and streamlines itself. The practical difficulty of towing antarctic icebergs may have been underestimated, and it might be worth reconsidering preliminary shaping of the iceberg to reduce the drag. (Auth.)

MP 1276
COMPARISON OF THE PEBBLE ORIENTATION IN ICE AND DEPOSITS OF THE MATANUSKA GLACIER, ALASKA.

Lawson, D.E., *Journal of geology,* Nov. 1979, 87(6), p.629-645, 21 refs.
34-2502
GLACIAL DEPOSITS, ICE STRUCTURE, SEDIMENT TRANSPORT.

Depositional processes and their sediment source determine the orientation of pebbles in the deposits of the Matanuska

Glacier and the relationship of this orientation to the direction of ice flow. Pebble fabrics in ice-derived deposits differ from those in resedimented deposits: fabric in deposits from sediment flow, ablation of exposed basal zone ice, and the slumping and spalling of ice-cored slopes does not correspond to the ice flow direction, but is developed by these depositional processes. Pebbles in basal ice and melt-out till show a unimodal distribution of orientations, with individual observations only slightly dispersed about the mean axis. Pebble fabrics in other deposits are polymodal, with a significantly larger amount of dispersion about the mean axis. The regional pattern of mean axes of basal zone ice and melt-out till pebble fabrics approximates the local and regional trends of ice flow, but pebble imbrication in ice and sediment does not necessarily indicate the direcsion from which the glacier flowed. A small number of measurements of pebble orientations at many sites and the analysis of these data by the eigenvalue method appear to be suitable techniques for examining the pebble fabric of glacial deposits, but additional sedimentological data are needed to define the origins of these deposits.

MP 1277

CRYSTAL ALIGNMENTS IN THE FAST ICE OF ARCTIC ALASKA.

Weeks, W.F., et al, *Journal of geophysical research,* Feb. 20, 1980, 85(C2), p.1137-1146, For this paper in another form see 34-1379 (CR 79-22, ADA-077 188). 8 refs.

Gow, A.J.

34-2671

SEA ICE, ICE PHYSICS, ICE CRYSTAL STRUCTURE, OCEAN CURRENTS.

Field observations at 60 sites located in the fast or near-fast ice along a 1200-km stretch of the north coast of Alaska between the Bering Strait and Barter Island have shown that 95% of the ice samples exhibit striking *c* axis alignments within the horizontal plane. In all cases the degree of preferred orientation increased with depth in the ice. Representative standard deviations around a mean direction in the horizontal plane are commonly less than 10 deg for samples collected near the bottom of the ice. The general patterns of the alignments support the correlation between the preferred *c* axis direction and the current direction at the ice/water interface suggested by Weeks and Gow (1978). A comparison between *c* axis alignments and instantaneous current measurements made at 42 locations shows that the most frequent current direction coincides with mean *c* axis direction. The *c* axis alignments are believed to be the result of geometric selection, with the most favored orientation being that in which the current flows normal to the (0001) plates of ice that comprise the dendritic sea ice/seawater interface.

MP 1278

TRAVELING WAVE SOLUTIONS OF SATURATED-UNSATURATED FLOW THROUGH POROUS MEDIA.

Nakano, Y., *Water resources research,* Feb. 16, 1980, 16(1), p.117-122, 9 refs.

34-2672

WAVE PROPAGATION, WATER FLOW.

Traveling wave solutions to the problem of saturated-unsaturated flow of water through a uniform porous medium are derived, and the regularity properties of the solutions are studied. It is found that a singularity occurs in the higher-order derivatives of flux with respect to the space coordinate in the solutions at water tables and that the water tables can be generally interpreted as propagating acceleration waves of the *n*th order, where *n* is a positive integer.

MP 1279

PILOT SCALE STUDY OF OVERLAND FLOW LAND TREATMENT IN COLD CLIMATES.

Jenkins, T.F., et al, *Progress in water technology,* 1979, 11(4/5), p.207-214, 11 refs.

Martel, C.J.

34-2673

WASTE TREATMENT, WATER CHEMISTRY, IRRIGATION, COLD WEATHER TESTS.

Primary and secondary wastewaters were applied to separate sections of an overland flow site. The dimensions of each section were 3 m in width by 30 m in length and the system was graded to a five percent slope. The site was planted with orchard grass and tall fescue. A one-year acclimation period was allowed to obtain a good cover. Wastewater was applied to the site for one month before onset of the study to establish a high level of microbial activity. Applied wastewater as well as surface and subsurface flows were monitored for NO-3, NH+4, TKN, BOD, suspended solids, pH, conductivity, and total phosphorus. The results indicate excellent warm weather performance for removal of oxygen demanding substances, suspended matter and nitrogen. Treatment efficiency of suspended solids remained high throughout the winter while treatment of BOD declined to unacceptable levels at soil temperatures below 4C. Nitrogen treatment declined rapidly below 14C. The form of nitrogen applied to overland flow was found to affect performance with nitrate being the less desirable form. Phosphorus treatment by overland flow was found to be about 80% in the summer months, declining to nil during the winter.

MP 1280

LOW-FREQUENCY SURFACE IMPEDANCE MEASUREMENTS AT SOME GLACIAL AREAS IN THE UNITED STATES.

Arcone, S.A., et al, *Radio science,* Jan.-Feb. 1980, 15(1), p.1-9, 14 refs.

Delaney, A.J.

34-2674

RADIO WAVES, WAVE PROPAGATION, RADIO COMMUNICATION.

Measurements of apparent resistivity and phase derived from the complex surface impedance of radio waves propagating in the ground wave mode at frequencies in the radio navigational aid band (between 257 and 382 kHz) are presented. Areas encompassing between 400 and 800 sq km that covered a variety of glacial sediments, land forms, and some crystalline bedrock types were surveyed. The degree of dispersion found in resistivity values reflects the dispersion in grain size, while the average resistivity increases with mean grain size. Dielectric properties are suggested as one cause of the low phases observed over crystalline bedrock. The combination of apparent resistivity and phase data implies that the resistivity measurements are consistent in about 50% of the areas with previous measurements of field strength attenuation performed in the AM broadcast band.

MP 1281

MARGIN OF THE GREENLAND ICE SHEET AT ISUA.

Colbeck, S.C., et al, *Journal of glaciology,* 1979, 24(90), p.155-165, In English with French and German summaries. 7 refs.

Gow, A.J.

34-2824

ICE SHEETS, ICE EDGE, DRILL CORE ANALYSIS, ICE STRUCTURE.

Field studies at a particular place at the margin of the Greenland ice sheet have provided information about the ice sheet. Ice temperatures were measured in five drill holes, two of which reached the unfrozen area of basal melting. Surface water entered these two bore holes, reaching the base in one, but remaining 59 m above the base in the other. The existence of this water conduit or fracture at 240 m depth, the calculated temperature profiles, and the local bedrock configuration suggest an area of stationary ice overridden by the ice sheet. This situation suggests creep rupture at depth in the ice sheet. Ice-fabric analysis made above 240 m depth shows patterns similar to fabrics elsewhere near the margin in zones of low deviatoric stress. Unfortunately, no cores were obtained below that depth where stationary ice may exist.

MP 1282

RELATIONSHIP OF ULTRASONIC VELOCITIES TO C-AXIS FABRICS AND RELAXATION CHARACTERISTICS OF ICE CORES FROM BYRD STATION, ANTARCTICA.

Gow, A.J., et al, *Journal of glaciology,* 1979, 24(90), p.147-153, In English with French and German summaries. 12 refs.

Kohnen, H.

34-2823

ICE SHEETS, ICE MECHANICS, DRILL CORE ANALYSIS, RELAXATION (MECHANICS), ULTRASONIC TESTS, ANTARCTICA—BYRD STATION.

Deep cores from Byrd Station were used to calibrate an ultrasonic technique of evaluating crystal anisotropy in the antarctic ice sheet. Velocities measured parallel and perpendicular to the vertical axis of the cores yielded data in excellent agreement with the observed c-axis fabric profile and with the *in-situ* P-wave velocity profile measured parallel to the bore-hole axis by Bentley. Velocity differences in excess of 140 m/s for cores from below 1,300 m attest to the tight clustering of *c* axes of crystals about the vertical, especially in the zone 1,300-1,800 m. A small but significant decline in vertical velocity with ageing of the core, as deduced from Bentley's down-hole data, is attributed to the formation of oriented cracks that occur in the ice cores as they relax from environmental stresses. This investigation of cores from the 2,164 m thick ice sheet at Byrd Station establishes the ultrasonic technique as a viable method of monitoring relaxation characteristics of drilled cores and for determining the gross trends of *c* axis orientation in ice sheets. The Byrd Station data, in conjunction with Barkov's investigation of deep cores from Vostok, East Antarctica, also indicate that crystal anisotropy in the antarctic ice sheet is dominated by a clustering of c-axis about a vertical symmetry axis. (Auth.)

MP 1283

ANALYSIS OF CIRCULATION PATTERNS IN GRAYS HARBOR, WASHINGTON, USING REMOTE SENSING TECHNIQUES.

Gatto, L.W., *Marine geodesy,* 1980, Vol.3, p.289-323, 45 refs.

34-2675

REMOTE SENSING, TIDAL CURRENTS, WATER FLOW.

The objective of this investigation was to analyze surface circulation patterns in Grays Harbor, Washington, during flood and ebb tide, using National Aeronautics and Space Administration (NASA) aerial photographs and thermal-IR imagery and low altitude aerial photographs of uranine dye drogues. The application of LANDSAT-1 and passive microwave imagery was evaluated but did not prove useful. Water temperature, salinity, and suspended sediment data and the results of hydraulic model studies were used to verify and supplement interpretations from the photographs and imagery. The use of remote sensing techniques in conjunction with ground truth data and hydraulic model results, when available, provides a more complete perspective of estuarine processes than is available by using conventional shipboard surveys alone.

MP 1284

IMAGING RADAR OBSERVATIONS OF FROZEN ARCTIC LAKES.

Elachi, C., et al, *Remote sensing of environment,* 1976, 5(3), p.169-175, 14 refs.

Bryan, M.L., Weeks, W.F.

34-2580

RADAR ECHOES, FROZEN LAKES, BACKSCATTERING, REMOTE SENSING, BUBBLES, ICE WATER INTERFACE, ICE SOLID INTERFACE.

L-band radar images of a number of ice-covered lakes located approx 48 km northwest of Bethel, Alaska, show large differences in radar backscatter with lakes showing homogeneous low-returns, homogeneous high-returns and/or low-returns around the lake borders and high-returns from the central areas. The patterns of the returns suggest that a low-return indicates that the lake is frozen completely to its bottom, while a high-return indicates the presence of freshwater between the ice cover and the lake bed. This interpretation is in good agreement with the limited information available on lake depths in the study area and recent X-band radar observations of North Slope lakes by Sellman, Weeks and Campbell, who suggested such an interpretation. These effects are, however, more striking in the L-band than in the X-band imagery. This can be explained by the fact that volume inhomogeneities, such as air bubbles, will cause more scattering and conductivity losses and thus more attenuation at the shorter wavelengths (X-band, 3 cm).

MP 1285

WATER MOVEMENT IN A LAND TREATMENT SYSTEM OF WASTEWATER BY OVERLAND FLOW.

Nakano, Y., et al, *Progress in water technology,* 1979, 11(4/5), p.185-206, 15 refs.

Khalid, R.A., Patrick, W.H., Jr.

34-3949

WATER FLOW, WASTE TREATMENT, WATER TREATMENT, SOIL WATER, SATURATION, SEEPAGE, SLOPE ORIENTATION, EXPERIMENTATION.

Water movement in an overland-flow land treatment system was studied experimentally and theoretically. A small-scale physical model was used to obtain experimental data. The theoretical analysis was based upon the shallow water equation for overland flow and the Darcy-Richards law for soil water flow. It was found that the water movement in the system was primarily controlled by the application rate, the friction slope, the slope angle, the hydraulic characteristics of soils, and the evapotranspiration. An approximate analytical solution to steady flow in the system was obtained. It was found that the rate of soil water flow was mainly determined by the saturated conductivity of soils and in less extent by the friction slope and the slope angle in the steady condition. A finite difference solution to non-steady flow was found satisfactory in simulating the experimental data.

MP 1286

MASS-BALANCE ASPECTS OF WEDDELL SEA PACK-ICE.

Ackley, S.F., *Journal of glaciology,* 1979, 24(90), p.391-405, In English with French and German summaries. 20 refs.

34-2840

SEA ICE DISTRIBUTION, MASS BALANCE, ICE DEFORMATION, SALINITY, WEDDELL SEA.

The Weddell Sea pack ice undergoes several unique advance-retreat characteristics related to the clockwise transport in the Weddell Gyre, the physical setting for the pack ice, and the free boundary with the oceans to the north. From satellite-derived ice charts, the annual cycle of the pack ice advance and retreat is depicted. The Weddell pack advance is characterized by a strong east-moving component as well as the north advance seen in other regions such as East Antarctica. Physical characteristics of the pack ice at the summer minimum ice edge are presented. Indications are that deformation is a significant component of the ice accumulation, deformed ice accounting for c. 15 to 20% of the area covered in the year-round pack. Ablation characteristics are inferred from observations made during field work and from satellite imagery. These observations indicate that surface-melt ablation typically seen on Arctic pack is not seen on the Weddell pack inside the summer edge. Using the physical-property data and transport inferred from ship and iceberg drifts, a new annual ice accumulation >3 m is inferred over the continental shelf in the South compared to <2 m previously estimated. The implication is that salt flux into the ocean over the shelf may be significantly larger, thereby increasing the production of Western Shelf Water, a component of Antarctic Bottom Water. (Auth.)

MP 1287

DELINEATION AND ENGINEERING CHARACTERISTICS OF PERMAFROST BENEATH THE BEAUFORT SEA.

Sellmann, P.V., et al, Environmental assessment of the Alaskan continental shelf, Vol. 9, Hazards. Principal investigators' annual reports for the year ending March 1979, Boulder, Colorado, Outer Continental Shelf Environmental Assessment Program, Oct. 1979, p.93-115, 19 refs.
Chamberlain, E.J., Arcone, S.A., Blouin, S.E., Delaney, A.J., Neave, K.G.
34-3056

SUBSEA PERMAFROST, PERMAFROST DISTRIBUTION, BOTTOM SEDIMENT, BOREHOLES, TEMPERATURE MEASUREMENT, ENGINEERING GEOLOGY, SEISMIC SURVEYS, OFFSHORE DRILLING, SEASONAL FREEZE THAW, BEAUFORT SEA.

The objective of CRREL's subsea permafrost program is to obtain information on the distribution and properties of permafrost beneath the Beaufort Sea. We are currently acquiring information on the distribution of ice-bonded permafrost from analysis of the velocity structure of commercial seismic records. This report summarizes the results of all studies to date, including engineering property analysis and preliminary interpretation of seismic data. Emphasis is placed on results that are relevant to offshore development of this region. Discussion of the CRREL drilling and laboratory program represents the most current interpretation of these data.

MP 1288

BURIED VALLEYS AS A POSSIBLE DETERMINANT OF THE DISTRIBUTION OF DEEPLY BURIED PERMAFROST ON THE CONTINENTAL SHELF OF THE BEAUFORT SEA.

Hopkins, D.M., et al, Environmental assessment of the Alaskan continental shelf, Vol. 9, Hazards. Principal investigators' annual reports for the year ending March 1979, Boulder, Colorado, Outer Continental Shelf Environmental Assessment Program, Oct. 1979, p.135-141, 15 refs.
Sellmann, P.V., Chamberlain, E.J., Lewellen, R.I., Robinson, S.W.
34-3057

SUBSEA PERMAFROST, PERMAFROST DISTRIBUTION, BOREHOLES, BOTTOM SEDIMENT, RIVER BASINS, VALLEYS, BEAUFORT SEA.

MP 1289

OIL POOLING UNDER SEA ICE.

Kovacs, A., Environmental assessment of the Alaskan continental shelf, Vol.8, Transport. Principal investigators' annual reports for the year ending March 1979, Boulder, Colorado, Outer Continental Shelf Environmental Assessment Program, Oct. 1979, p.310-323, 3 refs.
34-3053

OIL SPILLS, SEA ICE, ICE ELECTRICAL PROPERTIES, BOTTOM ICE, FAST ICE, SUBGLACIAL OBSERVATIONS, OCEAN CURRENTS, ANISOTROPY, REMOTE SENSING, ECHO SOUNDING, ELECTROMAGNETIC PROPERTIES.

The object of the CRREL study is to: (a) determine the cause of the significant relief which exists under the fast ice, (b) measure the variations in the relief under fast ice, using electromagnetic echo sounding, (c) determine if the under-ice relief is a series of individual pockets or consists of long rills, (d) estimate the quantity of oil which could pool up in the under-ice depressions should oil be released under the ice cover (e) use impulse radar to study the electromagnetic properties and anisotropy of sea ice. Initial results from using a polarized radar antenna in the air from the NOAA helicopter indicate that the c-axis anisotropy can be determined from the air. Because this anisotropy is related to current direction, it should be possible to measure, from an airborne platform, the current direction at the ice/water interface.

MP 1291

DYNAMICS OF NEAR-SHORE ICE.

Kovacs, A., et al, Environmental assessment of the Alaskan continental shelf, Vol. 7, Transport. Principal investigators' annual reports for the year ending March 1979, Boulder, Colorado, Outer Continental Shelf Environmental Assessment Program, Oct. 1979, p.181-207, 2 refs.
Weeks, W.F.
34-3051

ICE MECHANICS, SEA ICE, ICE COVER THICKNESS, ICE STRUCTURE, ICE CRYSTALS, PRESSURE RIDGES, REMOTE SENSING, FAST ICE, PACK ICE.

MP 1292

INTERNATIONAL WORKSHOP ON THE SEASONAL SEA ICE ZONE, MONTEREY, CALIFORNIA, FEB. 26-MAR.1, 1979.

Andersen, B.G., ed, *Cold regions science and technology,* Apr. 1980, Vol.2, 357p., For individual papers see 34-3625 through 34-3632 or B-23446, F-23442 through F-23445, and F-23447.
Weeks, W.F., ed, Newton, J.L., ed.
34-3624

MEETINGS, SEA ICE, PACK ICE, ICE PILEUP, ACOUSTICS, CLIMATOLOGY, ECOLOGY, OCEANOGRAPHY.

This volume comprises a series of state-of-the-art papers by individual authors, followed by disciplinary panel statements offering research suggestions and identifying particular problems with the discipline under consideration. Several interdisciplinary panel reports are included—air-sea-ice interactions, biological interactions, engineering interactions, and acoustic interactions.

MP 1293

OVERVIEW [INTERNATIONAL WORKSHOP ON THE SEASONAL SEA ICE ZONE].

Weeks, W.F., *Cold regions science and technology,* Apr. 1980, Vol.2, p.1-35, 2 refs.
34-3625

SEA ICE DISTRIBUTION, SEASONAL VARIATIONS, MEETINGS, MODELS, AIR WATER INTERACTIONS, ICE WATER INTERFACE, METEOROLOGY, ENGINEERING, OCEANOGRAPHY, OFFSHORE DRILLING.

This overview is an attempt to summarize the principal conclusions that can be drawn from the workshop. The article is divided into three sections: disciplinary studies (ice, oceanography, meteorology and climatology, biological regimes, hydroacoustics, coastal processes); interdisciplinary studies; and engineering aspects of offshore resource exploration in the polar regions. Modeling of a wide variety of processes is discussed.

MP 1294

PHYSICAL OCEANOGRAPHY OF THE SEASONAL SEA ICE ZONE.

McPhee, M.G., *Cold regions science and technology,* Apr. 1980, Vol.2, p.93-132, Refs. p.116-118. Includes disciplinary panel statement, p.119-132.
34-3627

POLYNYAS, OCEANOGRAPHY, SEA ICE, ICE WATER INTERFACE, SEASONAL VARIATIONS, SALINITY, ICE EDGE.

This literature review is divided into four parts. The first deals with the role of continental shelves at the margins of polar oceans in maintaining water masses; the second emphasizes how the ocean might affect the advance and retreat of ice not contained by land; the third describes some special conditions found in the shear zone; and the fourth is a brief look at experimental techniques and instruments.

MP 1295

SHORE ICE PILE-UP AND RIDE-UP: FIELD OBSERVATIONS, MODELS, THEORETICAL ANALYSES.

Kovacs, A., et al, *Cold regions science and technology,* Apr. 1980, Vol.2, p.209-298, Refs. p.282-288. Includes disciplinary panel statement.
Sodhi, D.S.
34-3631

SHORES, COASTAL TOPOGRAPHIC FEATURES, ICE PILEUP, SEA ICE, FAST ICE, PRESSURE RIDGES, MATHEMATICAL MODELS.

MP 1296

NUMERICAL MODELING OF SEA ICE IN THE SEASONAL SEA ICE ZONE.

Hibler, W.D., III, *Cold regions science and technology,* Apr. 1980, Vol.2, p.299-356, Refs. p.317-320. Includes disciplinary panel statement.
34-3632

SEA ICE, SEASONAL VARIATIONS, COMPUTERIZED SIMULATION, ICE MODELS, MATHEMATICAL MODELS.

Various approaches to modelling sea ice have been tried by investigators; the author discusses the suitability of different types of simulations for particular research goals. Empirical studies are also reviewed. Literature covered relates to ice in both arctic and antarctic regions.

MP 1297

DYNAMICS OF SNOW AND ICE MASSES.

Colbeck, S.C., ed, New York, Academic Press, 1980, 468p., Numerous refs. passim., Numerous refs. For individual papers see 34-3656 through 34-3662 or F-23452 through F-23455.
34-3655

ICE SHEETS, ICE SHELVES, GLACIERS, SEA ICE, ICEBERGS, AVALANCHES, SNOW, ICE.

This book reviews the dynamical aspects of snow and ice masses on the geophysical scale. It is divided into seven chapters, each of which describes the basic features of a particular snow or ice mass. In each chapter a conceptual framework is established on a physical basis, and a mathematical description is provided with as many references to the technical literature as space allows. No attempt is made to address particular applications of the information, but the physical and mathematical descriptions of the properties and processes provide for both an understanding of snow and ice masses and a basis through which particular problems can be addressed.

MP 1298

SEA ICE GROWTH, DRIFT, AND DECAY.

Hibler, W.D., III, Dynamics of snow and ice masses, edited by S.C. Colbeck, New York, Academic Press, 1980, p.141-209, Refs. p.205-209.
34-3658

DRIFT, SEA ICE, THICKNESS, ICE COVER THICKNESS, ICE SURFACE, ICE FORMATION, MODELS, ICE STRENGTH, SIMULATION.

This review of the dynamics of sea ice is organized into the following sections: general characteristics of sea ice; physics of sea ice growth, drift and decay (ice thickness distribution, thermal processes and ice drift and deformation); and numerical simulation of sea ice growth, drift and decay.

MP 1299

FRESHWATER ICE GROWTH, MOTION, AND DECAY.

Ashton, G.D., Dynamics of snow and ice masses, edited by S.C. Colbeck, New York, Academic Press, 1980, p.261-304, Refs. p.302-304.
34-3660

LAKE ICE, RIVER ICE, FRAZIL ICE, RIVERS, ICE JAMS, ICE BREAKUP, ICE MELTING, ICE FLOES, ICE FORMATION.

MP 1300

SOME PROMISING TRENDS IN ICE MECHANICS.

Assur, A., Symposium on Physics and Mechanics of Ice, Copenhagen, Aug. 6-10, 1979. Proceedings. Edited by P. Tryde, Berlin, Springer-Verlag, 1980, p.1-15, 12 refs.
34-3728

ICE MECHANICS, ICE CREEP, ICE SHEETS, STRESSES, LOADS (FORCES), ICE MODELS, RHEOLOGY, ICE COVER THICKNESS, SEA ICE, ANALYSIS (MATHEMATICS).

Ice sheets are inhomogeneous; properties vary strongly with depth. Theoretical treatment of plates with properties varying perpendicular to the plate has now been satisfactorily developed for floating ice sheets. However, other problems are still waiting for solutions. The use of model ice is developing rapidly. Some suggestions of how to analyze such ice are made. Breakthrough-loads on ice sheets diminish with duration of loading, but no satisfactory solution is available based upon classical procedures of applied mechanics.

MP 1301

EXPERIENCE GAINED BY USE OF EXTENSIVE ICE LABORATORY FACILITIES IN SOLVING ICE PROBLEMS.

Frankenstein, G.E., Symposium on Physics and Mechanics of Ice, Copenhagen, Aug. 6-10, 1979. Proceedings. Edited by P. Tryde, Berlin, Springer-Verlag, 1980, p.93-103, 12 refs.
34-3735

ICE MECHANICS, ICE NAVIGATION, ICE CONDITIONS, OFFSHORE STRUCTURES, ICE LOADS, FLOATING ICE, ICING, ICE PILEUP, FLOODING, LABORATORY TECHNIQUES.

The discovery of offshore oil in ice-infested waters has caused major concern to the design engineers. Some of the problems associated with offshore structures are ice forces, icing, and pile-up. Laboratory facilities have and will continue to solve many of the ice problems. The ice problem at navigation locks, for example, has been solved primarily due to laboratory studies. Also, the results of ice forces due to ice uplift have been virtually eliminated by controlled studies. Laboratories are becoming larger and more sophisticated. This should result in an increase in laboratory studies and a decrease in field studies. Solutions will come faster because conditions can be precisely controlled.

MP 1302

MECHANICAL PROPERTIES OF POLYCRYSTALLINE ICE.

Mellor, M., Symposium on Physics and Mechanics of Ice, Copenhagen, Aug. 6-10, 1979. Proceedings. Edited by P. Tryde. Berlin, Springer-Verlag, 1980, p.217-245.
34-3744

ICE CRYSTALS, ICE MECHANICS, ICE ELASTICITY, ICE CREEP, ICE STRENGTH, ICE CRACKS, VISCOELASTICITY, STRESS STRAIN DIAGRAMS, BRITTLENESS, TEMPERATURE EFFECTS.

MP 1303
BENDING AND BUCKLING OF A WEDGE ON AN ELASTIC FOUNDATION.
Nevel, D.E., Symposium on Physics and Mechanics of Ice, Copenhagen, Aug. 6-10, 1979. Proceedings. Edited by P. Tryde, Berlin, *Springer-Verlag*, 1980, p.278-288, 5 refs.
34-3747
ICE WEDGES, FOUNDATIONS, ELASTIC PROPERTIES, ICE CRACKS, FLEXURAL STRENGTH, LOADS (FORCES), ICE DEFORMATION, ANALYSIS (MATHEMATICS).

When an ice sheet begins to slide up a sloping structure, the ice cracks radially form the structure creating wedges. Beam theory is used to analyze these wedges under the influence of both horizontal and vertical forces. Buckling and bending of these wedges are considered.

MP 1304
ICE FORCES ON THE YUKON RIVER BRIDGE —1978 BREAKUP.
Johnson, P.R., et al, *U.S. Federal Highway Administration. Offices of Research and Development. Report*, Feb. 1979, FHWA-RD-79-82, 40p., PB80-144 553, 19 refs.
McFadden, T.
34-3725
PIERS, BRIDGES, ICE LOADS, ICE PRESSURE, ICE MECHANICS, ICE STRENGTH, IMPACT STRENGTH, ICE BREAKUP, RIVER ICE.

MP 1305
THE ICEBERG COMETH.
Weeks, W.F., et al, *Technology review*, Aug.-Sep. 1979, 81(8), p.66-75, 6 refs.
Mellor, M.
34-3793
ICEBERG TOWING.

The potential of towing icebergs to arid regions in the Southern Hemisphere is reviewed. Formidable technical problems exist; some proposed solutions are listed. However, very little has been done to test the technology proposed. Towing, insulation, routes, and other aspects of iceberg-towing technology should be investigated by a trial tow to Western Australia, the area most favorably located for southern iceberg delivery.

MP 1306
PRESSURE WAVES IN SNOW.
Brown, R.L., *Journal of glaciology*, 1980, 25(91), p.99-107, 9 refs., In English with French and German summaries.
34-3802
SHOCK WAVES, SNOW DENSITY, LOADS (FORCES), SNOW STRENGTH, SHEAR STRESS, SNOW COMPRESSION, ANALYSIS (MATHEMATICS).

A dynamic constitutive law is used to study the response of medium-density snow to shock waves. The results show good correlation between theory and experiment, except for low-intensity shocks which produce small permanent density changes. In this case the validity of the data is questioned, although further experimental work is needed to settle this question. The results of this work also partially explain why snow is so effective in absorbing energy associated with stress waves. This is felt to be due to the work-hardening characteristics of snow.

MP 1307
APPLICATION OF RECENT RESULTS IN FUNCTIONAL ANALYSIS TO THE PROBLEM OF WETTING FRONTS.
Nakano, Y., *Water resources research*, Apr. 1980, 16(2), p.314-318, 16 refs.
34-3948
SOIL WATER MIGRATION, SOIL PHYSICS, BOUNDARY VALUE PROBLEMS, SEEPAGE, POROUS MATERIALS, WETTABILITY, ANALYSIS (MATHEMATICS).

Traditionally, in hydrology and soil physics, wetting fronts appearing in porous media described by Darcy's law have not generally been considered to be singular surfaces. Some recent results from functional analysis are presented as evidence supporting the viewpoint that wetting fronts with a finite propagating speed generally are singular surfaces.

MP 1308
TIME-PRIORITY STUDIES OF DEEP ICE CORES.
Gow, A.J., *Glaciological data*, May 1980, GD-8, p.91-102, 18 refs.
34-4030
ICE CORES, DRILL CORE ANALYSIS, ANTARCTICA—BYRD STATION.

Both the Greenland and Antarctic ice sheets have been successfully core-drilled to bedrock, 1390 m at Camp Century, Greenland in 1966 and 2164 m at Byrd Station, Antarctica in 1968. Core and borehole studies at both sites have revealed a wealth of interesting results, especially at Byrd Station where extensive studies of cores were begun as soon as they were pulled out of the drill hole. Continuing investigations of these Byrd Station drill cores, including recent observations of apparent widespread recrystallization in certain sections of ice core, further confirm the importance of initiating as many studies as possible at the drill site. Any list of the studies that should be conducted on deep ice cores must recognize two kinds of research: 1) those studies of a time-priority nature that must be initiated as soon as cores are pulled to the surface and, 2) other essential studies in which relaxation of the ice is not a factor. These latter studies can generally be deferred until cores are transported to more permanent storage facilities outside Antarctica. (Auth. mod.)

MP 1309
SMALL-SCALE TESTING OF SOILS FOR FROST ACTION.
Sayward, J.M., *Geotechnical testing journal*, 1979, 2(4), p.223-231, 18 refs.
34-3990
FROST ACTION, FROST HEAVE, ICE NEEDLES, SOIL WATER MIGRATION, SOIL TESTS.

A method is described for convenient study of frost action, including soil heaving and needle ice formation. The apparatus is simple and small and the procedure requires only 25 cu cm soil specimens. The method could be useful for screening either large numbers or limited quantities of soils or soil additives for frost susceptibility. The method described was used to perform a limited number of tests with several soils. The tests obtained action in the form of soil heave, ice heave, or ice needles, yielding maximum heights up to three to six times the initial 40-mm soil depth. Maximum growth rates were up to 1 to 3 mm/hr for soil heaves and 3 to 7 or more mm/h for ice heaves and ice needles. Initial trials shewed that thickener additives and possibly other treatments can restrict frost action.

MP 1310
FATE AND EFFECTS OF CRUDE OIL SPILLED ON SUBARCTIC PERMAFROST TERRAIN IN INTERIOR ALASKA.
Johnson, L.A., et al, *U.S. Environmental Protection Agency. Environmental Research Laboratory. Report*, Mar. 1980, EPA-600/3-80-040, 128p., Refs. p.78-83.
Sparrow, E.B., Jenkins, T.F., Collins, C.M., Davenport, C.V., McFadden, T.
34-4079
OIL SPILLS, PERMAFROST THERMAL PROPERTIES, ENVIRONMENTAL IMPACT, THERMAL REGIME, SUBARCTIC REGIONS, SEASONAL VARIATIONS, EXPERIMENTATION.

This study was conducted to determine both the short- and long-term effects of spills of hot Prudhoe Bay crude oil on permafrost terrain in subarctic interior Alaska. Two experimental oil spills of 7570 liters (2000 gallons) each on 500 sq m test plots were made at a forest site underlain by permafrost near Fairbanks, Alaska. The oil spills, one in winter and one in summer, were conducted to evaluate their effect during these two seasonal extremes. Oil movement, thermal regime, botanical effects, microbiological responses, permafrost impact, and composition of the oil in the soil were monitored for two years.

MP 1311
FREE CONVECTION HEAT TRANSFER CHARACTERISTICS IN A MELT WATER LAYER.
Yen, Y.-C., *American Society of Mechanical Engineers. Transactions*, Aug. 1980, 102(3), p.550-556, 17 refs.
35-103
MELTWATER, HEAT TRANSFER, CONVECTION, ICE WATER INTERFACE, WATER TEMPERATURE, TEMPERATURE EFFECTS, ICE MELTING, ANALYSIS (MATHEMATICS).

An experimental study was conducted on the formation of a water layer containing a maximum density, its effect on the onset of convection, and the heat transfer characteristics of such a system. This water layer was formed by one-dimensional melting (either from below or above) of a cylinder of bubble-free ice. The layer depth at the onset of convection was determined by locating the inflection point on the water layer depth versus time curve, and was compared with layer depth calculated from a linear stability analysis of an identical problem. The results were compared with the analytical work of Veronis and were found to be in excellent agreement. Formation of a constant temperature layer was observed by measuring the water temperature distribution as melting progressed. The constant temperature was found to depend on T(h) (warm plate temperature) for melting from below, but had a weaker dependence for melting from above. The heat flux to the melting surface increased linearly with T(h) for melting from below, but had a weaker dependence for melting from above. Non-dimensional mean temperature profiles of the water layer were found to be in good agreement with those by Adrian for melting from above. In the case of melting from below, the mean temperature profile also fell into a single line with a somewhat higher value in the convection layer.

MP 1312
SNOW STUDIES ASSOCIATED WITH THE SIDEWAYS MOVE OF DYE-3.
Tobiasson, W., Eastern Snow Conference, 36th. Proceedings, Alexandria Bay, New York, 1979, p.117-124, 4 refs.
34-4210
SNOW STRENGTH, BEARING STRENGTH, FOUNDATIONS, STRESSES, SNOW COVER STABILITY, SNOW SURVEYS.

In 1977, DEW Line station DYE-3 on the Greenland Ice Cap was moved sideways 210 ft (64 m) onto a new undistorted foundation. When this life extension concept was proposed, abrupt failure of the supporting snow was a major concern. Snow samples were obtained and strength tested at CRREL to determine the chance of an abrupt failure of the supporting snow. Model studies were also performed to determine the bearing capacity of the snow, and predictions were made of foundation settlement during the move. The results indicated that the move could be accomplished safely.

MP 1313
REMOVAL OF VOLATILE TRACE ORGANICS FROM WASTEWATER BY OVERLAND FLOW LAND TREATMENT.
Jenkins, T.F., et al, *Journal of environmental science and health: Part A. Environmental science and engineering*, 1980, A15(3), p.211-224, 14 refs.
Leggett, D.C., Martel, C.J.
34-4200
WASTE TREATMENT, WATER TREATMENT, WASTE DISPOSAL.

A prototype overland flow land treatment system was studied to determine its effectiveness in reducing the levels of volatile trace organics in municipal wastewater. Chlorinated primary wastewater, water collected from the surface at various points downslope and runoff were analyzed by GC/MS, using a purge and trap sampler. Results indicated that efficient removal of a number of volatile substances including chloroform and toluene can be achieved by this method of treatment. Loss of these substances was found to follow first order kinetics. The observed behavior is consistent with a volatilization process.

MP 1314
WORKSHOP ON ENVIRONMENTAL PROTECTION OF PERMAFROST TERRAIN.
Brown, J., et al, *Northern engineer*, Summer 1980, 12(2), p.30-36, 8 refs.
Hemming, J.E.
34-4198
PERMAFROST PRESERVATION, ENVIRONMENTAL PROTECTION, MEETINGS, THERMAL EFFECTS, SOIL EROSION, ROUTE SURVEYS, SITE SURVEYS, DESIGN CRITERIA.

MP 1315
BREAK-UP OF THE YUKON RIVER AT THE HAUL ROAD BRIDGE: 1979.
Stephens, C.A., et al, Fairbanks, University of Alaska, Sep. 1979, 22p. + Figs., 5 refs. Report of field activities.
Hanscom, J.T., Osterkamp, T.E.
34-4193
RIVER ICE, ICE BREAKUP, ICE COVER THICKNESS, ICE FLOES, ICE ELECTRICAL PROPERTIES, WATER TEMPERATURE, ELECTRICAL RESISTIVITY, VELOCITY, UNITED STATES—ALASKA—YUKON RIVER.

MP 1316
MATERIALS AVAILABILITY STUDY OF THE DICKEY-LINCOLN DAM SITE.
Merry, C.J., et al, Case studies of applied advanced data collection and management, American Society of Civil Engineers, 1980, p.158-170, Also presented at the 12th International Symposium on Remote Sensing of Environment, Manila, Philippines, April 20-26, 1978.
McKim, H.L., Blackey, E.A.
35-153
EARTH DAMS, SITE SURVEYS, GEOLOGIC STRUCTURES, REMOTE SENSING, CONSTRUCTION MATERIALS, LAKES, TOPOGRAPHIC FEATURES, MAPPING.

MP 1317
BREAK-UP DATES FOR THE YUKON RIVER; PT.1. RAMPART TO WHITEHORSE, 1896-1978.
Stephens, C.A., et al, Fairbanks, University of Alaska, Geophysical Institute, Apr. 1979, c50 leaves, 10 refs.
Fountain, A.G., Osterkamp, T.E.
35-133
ICE BREAKUP, ICE DETERIORATION, ICE CONDITIONS, ICE NAVIGATION, STATISTICAL ANALYSIS, UNITED STATES—ALASKA—YUKON RIVER.

MP 1318

BREAK-UP DATES FOR THE YUKON RIVER; PT.2. ALAKANUK TO TANANA, 1883-1978.

Stephens, C.A., et al, Fairbanks, University of Alaska, Geophysical Institute, May 1979, c50 leaves, 8 refs.
Fountain, A.G., Osterkamp, T.E.
35-134
RIVER ICE, ICE BREAKUP, STATISTICAL ANALYSIS, ICE NAVIGATION, ICE CONDITIONS, UNITED STATES—ALASKA—YUKON RIVER.

MP 1319

ICE SHEET INTERNAL RADIO-ECHO REFLECTIONS AND ASSOCIATED PHYSICAL PROPERTY CHANGES WITH DEPTH.

Ackley, S.F., et al, *Journal of geophysical research,* Sep. 10, 1979, 84(B10), p.5675-5680, 13 refs.
Keliher, T.E.
34-999
ICE SHEETS, ICE CORES, RADIO ECHO SOUNDINGS, ICE PHYSICS, ANTARCTICA—FOLGER, CAPE.

In this paper, the measured physical properties of core to bedrock taken at Cape Folger, East Antarctica, are used to compute a depth-reflection coefficient profile for comparison with the observed radio-echo reflections. The measurements available on physical properties are density variations, bubble size and shape changes, and crystal fabric variations. In calculations to differentiate the effects of the physical properties, it appears that density variations account for the primary contributions to the calculated dielectric property changes corresponding to the highest observed reflection coefficients. However, bubble changes alone can also account for reasonable, though lower, reflection coefficients at the depths corresponding to observed reflections. Crystal fabric variations correspond poorly with the reflection locations. The close correspondence between the depths of the bubble shape changes (which are definitely deformational features) and the depths of the density variations, and between both of these and the radio-echo layers, indicates that deformational events in the ice sheet's history are represented by the variations in physical properties and associated radio-echo records. (Auth. mod.)

MP 1320

"PACK ICE AND ICEBERGS"—REPORT TO POAC 79 ON PROBLEMS OF THE SEASONAL SEA ICE ZONE: AN OVERVIEW.

Weeks, W.F., et al, International Conference on Port and Ocean Engineering Under Arctic Conditions, 5th, Trondheim, Norway, Aug. 13-18, 1979. Proceedings, Vol.3. Trondheim, University, 1979, p.320-337.
Denner, W.W., Paquette, R.G.
35-178
PACK ICE, ICEBERGS, SEA ICE DISTRIBUTION, ICE CONDITIONS, ICE PHYSICS, REMOTE SENSING, RESEARCH PROJECTS, SEASONAL VARIATIONS, SEA WATER.

This paper reports the results of the Seasonal Sea Ice Zone (SSIZ) Workshop, held February 26, 1979 in Monterey, California. The purpose of the workshop was to summarize the existing knowledge of the SSIZ, to identify significant problem areas, and discuss approaches to finding solutions. The purpose of the report is to make the participants of POAC 79 aware of the important research problems of the SSIZ identified at the Workshop.

MP 1321

PROCEEDINGS OF THE SPECIALTY CONFERENCE ON COMPUTER AND PHYSICAL MODELING IN HYDRAULIC ENGINEERING.

Ashton, G.D., ed, New York, American Society of Civil Engineers, 1980, 492p., Refs. passim. For selected paper see 34-4161.
35-255
HYDRAULICS, ENGINEERING, COMPUTER APPLICATIONS, ICE PHYSICS, MODELS.

MP 1322

REVIEW OF BUCKLING ANALYSES OF ICE SHEETS.

Sodhi, D.S., et al, *U.S. Army Cold Regions Research and Engineering Laboratory,* June 1980, SR 80-26, p.131-146, ADA-089 674, 14 refs.
Nevel, D.E.
35-511
ICE SHEETS, ICE LOADS, ICE PRESSURE, ICE STRENGTH, ANALYSIS (MATHEMATICS), PLATES.

A review of the buckling analyses of floating ice sheets is presented. The theory used is that of a beam or plate on an elastic foundation. For beams, the results for all possible boundary conditions are presented and discussed. For plates, results of numerical solutions for a semi-infinite plate loaded over part of its boundary are presented and discussed. One solution is presented for an infinite plate loaded radially at a hole in the plate. In addition, results for wedge-shaped beams and plates are presented and discussed. Wedge-shaped ice sheets frequently occur due to previous cracking in the ice.

MP 1323

INVESTIGATIONS OF SEA ICE ANISOTROPY, ELECTROMAGNETIC PROPERTIES, STRENGTH AND UNDER-ICE CURRENT ORIENTATION.

Kovacs, A., et al, *Memorial University of Newfoundland. Centre for Cold Ocean Resources Engineering. C-CORE publication,* May 1980, No.80-5, p.109-153, 16 refs.
Morey, R.M.
35-550
SEA ICE, ANISOTROPY, ELECTROMAGNETIC PROPERTIES, ICE STRENGTH, OCEAN CURRENTS, SUBGLACIAL OBSERVATIONS, REMOTE SENSING, ICE PHYSICS, ICE COVER THICKNESS, ICE WATER INTERFACE, ICE CRYSTAL STRUCTURE.

MP 1324

HF TO VHF RADIO FREQUENCY POLARIZATION STUDIES IN SEA ICE AT PT. BARROW, ALASKA.

Arcone, S.A., et al, *Memorial University of Newfoundland. Centre for Cold Ocean Resources Engineering. C-CORE publication,* May 1980, No.80-5, p.225-245, 8 refs.
Delaney, A.J.
35-553
SEA ICE, FAST ICE, POLARIZATION (WAVES), ANISOTROPY, ICE OPTICS, ICE COVER THICKNESS, ELECTROMAGNETIC PROPERTIES.

The frequency dependence of the polarization-rotation properties of fast ice upon radiowaves in the HF-VHF range were studied at Pt. Barrow, Alaska, in the early spring of 1979. Five sites were investigated at frequencies between 10 and 173 MHz and at each site cores were taken and then physical properties measured. The polarization was studied with a pair of crossed dipole antennas, one a transmitter, the other a receiver, both of which were rotated simultaneously as a fixed unit. This procedure was designed to produce a four-lobe cloverleaf pattern with maximum coupling occurring when the antennas were aligned at 45 deg to the c-axis direction. The results showed strongest polarization between about 35 and 65 MHz. Above this band the high dc conductivity of the sea ice which was measured accounts for the lack of cross coupling, but it is not yet understood why the data was so erratic below this band. Experimental difficulties are also discussed.

MP 1325

MODELING OF ANISOTROPIC ELECTROMAGNETIC REFLECTION FROM SEA ICE.

Golden, K.M., et al, *Memorial University of Newfoundland. Centre for Cold Ocean Resources Engineering. C-CORE publication,* May 1980, No.80-5, p.247-294, 21 refs.
Ackley, S.F.
35-554
SEA ICE, BRINES, ANISOTROPY, ELECTROMAGNETIC PROPERTIES, ICE OPTICS, ICE WATER INTERFACE, DIELECTRIC PROPERTIES, ICE STRUCTURE, POLARIZATION (WAVES), MATHEMATICAL MODELS.

The contribution of brine layers to observed reflective anisotropy of sea ice at 100 MHz is quantitatively assessed. The sea ice is considered to be a stratified, inhomogeneous, anisotropic dielectric consisting of pure ice containing ordered arrays of conducting inclusions (brine layers). Below the transition zone, the ice is assumed to have constant azimuthal c-axis orientation within the horizontal plane, so the orientation of brine layers is uniform. The brine layers are also assumed to become increasingly well-defined with depth, since adjacent brine inclusions tend to fuse together with increasing temperature. A theoretical explanation for observed reflective anisotropy is proposed in terms of anisotropic electric flux penetration into brine layers. Penetration anisotropy and brine layer geometry are linked to anisotropy in the complex dielectric constant of sea ice. Subsequently, a numerical method of approximating the reflected power of a plane wave pulse incident on a slab of sea ice is presented and used to show the contribution of the above effects to the observed reflective anisotropy.

MP 1326

POINT SOURCE BUBBLER SYSTEMS TO SUPPRESS ICE.

Ashton, G.D., *Cold regions science and technology,* Nov. 1979, 1(2), p.93-100, For another version see 33-4224. 8 refs.
35-695
ICE REMOVAL, BUBBLING, ICE MELTING, HEAT TRANSFER, ICE COVER THICKNESS, AIR TEMPERATURE, WATER TEMPERATURE, MATHEMATICAL MODELS.

An analysis of a point source bubbler system used to induce local melting of an ice cover is presented. The analysis uses empirical results of bubbler plume experiments and impingement heat transfer results to determine the rate of melting at the underside of an ice cover. Through a simple energy budget analysis of the ice cover, the melting of the ice cover and resulting extent of open water are determined as a function of air temperatures, depth and air discharge of the source, and water temperature. The analysis leads to a numerical simulation and an example simulation is presented.

MP 1327

PREPARATION OF POLYCRYSTALLINE ICE SPECIMENS FOR LABORATORY EXPERIMENTS.

Cole, D.M., *Cold regions science and technology,* Nov. 1979, 1(2), p.153-159, 10 refs.
35-700
ICE CRYSTALS, ICE SAMPLING, ICE STRUCTURE, LABORATORY TECHNIQUES, ICE MECHANICS, POROSITY, BUBBLES.

MP 1328

MECHANICAL PROPERTIES OF POLYCRYSTALLINE ICE: AN ASSESSMENT OF CURRENT KNOWLEDGE AND PRIORITIES FOR RESEARCH.

Hooke, R.L., et al, *Cold regions science and technology,* Aug. 1980, 3(4), p.263-275, For another version see 33-3545.
Mellor, M.
35-744
ICE CRYSTALS, ICE MECHANICS, ICE CREEP, ICE DEFORMATION, STRAIN TESTS, STRESS STRAIN DIAGRAMS, ICE STRENGTH.

MP 1329

SHIP RESISTANCE IN THICK BRASH ICE.

Mellor, M., *Cold regions science and technology,* Aug. 1980, 3(4), p.305-321, 8 refs.
35-748
ICE MECHANICS, ICE PRESSURE, SHIPS, IMPACT STRENGTH, ICE FRICTION, METAL ICE FRICTION, STRESSES, ICE NAVIGATION.

MP 1330

LOW TEMPERATURE PHASE CHANGES IN MONTMORILLONITE AND NONTRONITE AT HIGH WATER CONTENTS AND HIGH SALT CONTENTS.

Anderson, D.M., et al, *Cold regions science and technology,* May 1980, 3(2/3), p.139-144, 8 refs.
Tice, A.R.
35-728
UNFROZEN WATER CONTENT, SALINITY, TEMPERATURE EFFECTS, PHASE TRANSFORMATIONS, SOIL FREEZING, CLAYS, IONS, LOW TEMPERATURE TESTS.

Prior work has revealed the existence of one or more low temperature phase changes in clay water systems in the temperature range -20C to about -50C. The number and the temperatures at which these phase changes appear seems to be associated with the type of exchangable ion(s) and the number and nature of individual water domains present. In this paper, we report the results of low temperature differential calorimetry on montmorillonite and nontronite clays at high water and high salt contents. The presence of electrolytes at high concentration is shown to have a very marked effect. The low temperature phase changes are completely absent at high electrolyte concentrations in these clay water systems. The presence of electrolytes also was observed to have a distinctive effect on the shape of the initial freezing peak associated with ice segregation.

MP 1331

FROST HEAVE IN AN INSTRUMENTED SOIL COLUMN.

Berg, R.L., et al, *Cold regions science and technology,* May 1980, 3(2/3), p.211-221, 4 refs.
Ingersoll, J., Guymon, G.L.
35-737
FROST HEAVE, SOIL WATER, UNFROZEN WATER CONTENT, SOIL FREEZING, FROST PENETRATION, ICE FORMATION, TENSILE PROPERTIES, MEASURING INSTRUMENTS, TESTS.

MP 1332

SUMMARY OF THE ADSORPTION FORCE THEORY OF FROST HEAVING.

Takagi, S., *Cold regions science and technology,* May 1980, 3(2/3), p.233-236, 5 refs.
35-739
FROST HEAVE, ADSORPTION, SOIL PRESSURE, SOIL WATER MIGRATION, FREEZING POINTS, WATER FILMS, THEROIES.

MP 1333

ONE-DIMENSIONAL FROST HEAVE MODEL BASED UPON SIMULTANEOUS HEAT AND WATER FLUX.

Guymon, G.L., et al, *Cold regions science and technology,* May 1980, 3(2/3), p.253-262, 23 refs.
Hromadka, T.V., II, Berg, R.L.
35-742
FROST HEAVE, HEAT TRANSFER, SOIL WATER MIGRATION, SOIL FREEZING, MATHEMATICAL MODELS, HEAT FLUX.

MP 1334

ADSORPTION FORCE THEORY OF FROST HEAVING.

Takagi, S., *Cold regions science and technology*, May 1980, 3(1), p.57-81, Refs. p.73-76.
35-819
FROST HEAVE, ADSORPTION, SOIL WATER MIGRATION, SOIL FREEZING, HEAT TRANSFER, STRESSES, WATER FILMS, THEORIES, ANALYSIS (MATHEMATICS).

MP 1335

MODELING OF ICE IN RIVERS.

Ashton, G.D., Modeling of rivers. Edited by H.W. Shen, New York, John Wiley and Sons, 1979, p.14/1-14/26, Refs. p.14/22-14/26.
35-1127
RIVER ICE, ICE FORMATION, ICE BREAKUP, ICE LOADS, ICE JAMS, FRAZIL ICE, ICE FLOES, MODELS.

MP 1336

SEA ICE ON BOTTOM OF ROSS ICE SHELF.

Zotikov, I.A., et al, *Antarctic journal of the United States*, Oct. 1979, 14(5), p.65-66, 6 refs.
Zagorodnov, V.S., Raĭkovskiĭ, IU.V.
35-652
SEA ICE, ICE STRUCTURE, BOTTOM ICE, ANTARCTICA—ROSS ICE SHELF.

The authors describe the structure of the ice of Ross Ice Shelf as it appeared in a J-9 core. Comments are given on an unusual boundary layer showing in the core and conclusions and estimates on growth rate are made.

MP 1337

CORE DRILLING THROUGH ROSS ICE SHELF.

Zotikov, I.A., et al, *Antarctic journal of the United States*, Oct. 1979, 14(5), p.63-64, 2 refs.
Zagorodnov, V.S., Raĭkovskiĭ, IU.V.
35-651
ICE SHELVES, ICE CORING DRILLS, DRILLING, ANTARCTICA—ROSS ICE SHELF.

The ice drill and ice drilling methods and fluids used to pull a core from the Ross Ice Shelf are described and a brief analysis of the core is made.

MP 1338

SUBSURFACE MEASUREMENTS OF MCMURDO ICE SHELF.

Gow, A.J., et al, *Antarctic journal of the United States*, Oct. 1979, 14(5), p.79-80, 2 refs.
Kovacs, A.
35-659
ICE CORES, BRINES, ICE COMPOSITION, ANTARCTICA—MCMURDO SOUND.

Study of brine content of sea ice at McMurdo and its physical and chemical relationships to the ice and sea water was continued. Another continuing study concerns radar profiling up glacier from the exposed contact point of sea ice with the ice of Koettlitz Glacier.

MP 1339

DRIFTING BUOY MEASUREMENTS ON WEDDELL SEA PACK ICE.

Ackley, S.F., *Antarctic journal of the United States*, Oct. 1979, 14(5), p.106-108, 7 refs.
35-676
SEA ICE, DRIFT, TEMPERATURE MEASUREMENT.

The observational techniques of placing the buoys in the Weddell Sea are described, the drift record and the temperature measurement record are shown, and a preliminary assessment and interpretation of the data received is given.

MP 1340

TURBULENT HEAT FLUX FROM ARCTIC LEADS.

Andreas, E.L., et al, *Boundary-layer meteorology*, Aug. 1979, 17(1), p.57-91, 50 refs.
Paulson, C.A., Williams, R.M., Lindsay, R.W., Businger, J.A.
35-159
SEA ICE, HEAT TRANSFER, POLYNYAS, TURBULENT EXCHANGE.

MP 1341

PARTICULAR SOLUTIONS TO THE PROBLEM OF HORIZONTAL FLOW OF WATER AND AIR THROUGH POROUS MEDIA NEAR A WETTING FRONT.

Nakano, Y., *Advances in water resources*, June 1980, Vol.3, p.81-85, 9 refs.
35-844
POROUS MATERIALS, WATER FLOW, AIR FLOW, BOUNDARY VALUE PROBLEMS, WETTABILITY, SOIL WATER MIGRATION, INFILTRATION, ANALYSIS (MATHEMATICS).

MP 1342

PARTICULAR SOLUTIONS TO THE PROBLEM OF VERTICAL FLOW OF WATER AND AIR THROUGH POROUS MEDIA NEAR A WATER TABLE.

Nakano, Y., *Advances in water resources*, Sep. 1980, Vol.3, p.124-133, 12 refs.
35-845
POROUS MATERIALS, ANALYSIS (MATHEMATICS), WATER FLOW, AIR FLOW, WATER TABLE, BOUNDARY VALUE PROBLEMS, SOIL WATER MIGRATION, INFILTRATION.

MP 1343

THEORY AND NUMERICAL ANALYSIS OF MOVING BOUNDARY PROBLEMS IN THE HYDRO-DYNAMICS OF POROUS MEDIA.

Nakano, Y., *Water resources research*, Feb. 1978, 14(1), p.125-134, 14 refs.
35-843
POROUS MATERIALS, HYDRODYNAMICS, BOUNDARY VALUE PROBLEMS, SOIL WATER MIGRATION, WATER FLOW, ANALYSIS (MATHEMATICS), THEORIES.

MP 1344

DELINEATION AND ENGINEERING CHARACTERISTICS OF PERMAFROST BENEATH THE BEAUFORT SEA.

Sellmann, P.V., et al, Environmental assessment of the Alaskan continental shelf. Vol.2. Principal investigators' reports April-December 1979. Boulder, Colorado, Outer Continental Shelf Environmental Assessment Program, March 1980, p.103-110.
Chamberlain, E.J.
35-1153
SUBSEA PERMAFROST, PERMAFROST DISTRIBUTION, DRILL CORE ANALYSIS, SEISMIC SURVEYS, BOTTOM SEDIMENTS, ENGINEERING, MAPPING.

MP 1345

SOVIET CONSTRUCTION UNDER DIFFICULT CLIMATIC CONDITIONS.

Assur, A., Soviet housing and urban design. Edited by S.A. Grant. U.S. Dept. of Housing and Urban Development, Sep. 1980, p.47-53.
35-1397
COLD WEATHER CONSTRUCTION, PERMAFROST BENEATH STRUCTURES, PREFABRICATION, STANDARDS, HOUSES.

MP 1346

PERMAFROST BENEATH THE BEAUFORT SEA: NEAR PRUDHOE BAY, ALASKA.

Sellmann, P.V., et al, *Journal of energy resources technology*, Mar. 1980, 102(1), p.35-48, For the same paper from another source see 33-3864. 34 refs.
Chamberlain, E.J.
35-1105
SUBSEA PERMAFROST, OFFSHORE DRILLING, PROBES, PENETRATION TESTS, BOTTOM SEDIMENT, OCEAN BOTTOM.

MP 1347

IMPACT FUSE PERFORMANCE IN SNOW (INITIAL EVALUATION OF A NEW TEST TECHNIQUE).

Aitken, G.W., et al, Army Science Conference, 12th, West Point, N.Y., U.S. Military Academy, June 17-20, 1980. Proceedings, Vol.1, Washington, D.C., Department of the Army, July 21, 1980, p.31-45, ADA-090 350, 8 refs.
Richmond, P.W., Albert, D.G.
35-1584
SNOW COVER, SNOW LOADS, EXPLOSION EFFECTS, IMPACT STRENGTH, PROJECTILE PENETRATION, VELOCITY, TESTS.

MP 1348

EVALUATION OF ICE-COVERED WATER CROSSINGS.

Dean, A.M., Jr., Army Science Conference, 12th, West Point, N.Y., U.S. Military Academy, June 17-20, 1980. Proceedings, Vol.1, Washington, D.C., Department of the Army, July 21, 1980, p.443-453, ADA-090 350, 11 refs.
35-1587
ICE CROSSINGS, ICE COVER STRENGTH, BEARING STRENGTH, FLOATING ICE, ICE COVER THICKNESS, MEASURING INSTRUMENTS.

MP 1349

LIQUID DISTRIBUTION AND THE DIELECTRIC CONSTANT OF WET SNOW.

Colbeck, S.C., Workshop on the Microwave Remote Sensing of Snowpack Properties, Fort Collins, Colorado, May 20-22, 1980. Proceedings. Edited by A. Rango. NASA conference publication 2153, Washington, D.C., NASA, Scientific and Technical Information Office, Oct. 1980, p.21-39, 15 refs.
35-1735
WET SNOW, DIELECTRIC PROPERTIES, PERMEABILITY, LIQUID SOLID INTERFACES, SNOW WATER CONTENT, SNOW ELECTRICAL PROPERTIES, SNOW DENSITY, SNOW COVER STRUCTURE, WATER FLOW, POROSITY, ANALYSIS (MATHEMATICS).

The mixing theory of Polder and Van Santen is revised for application to three cases of wet snow. The dielectric constant is calculated for a range of liquid contents and porosities. These calculated values compare favorably with experimental data for the two cases in which data are available. The application to a snow cover with a heterogeneous distribution of liquid is discussed. The possibility of applying this theory to calculate the imaginary part of the dielectric constant must be explored further.

MP 1350

ROAD AND ITS ENVIRONMENT.

Brown, J., *U.S. Army Cold Regions Research and Engineering Laboratory. Report*, Sep. 1980, CR 80-19, p.3-52, ADA-094 497.
35-1769
ROADS, CONSTRUCTION, ENVIRONMENTS, PIPELINES, PERMAFROST, CLIMATE, VEGETATION, GEOLOGY, GROUND ICE, UNITED STATES—ALASKA.

MP 1351

ROAD PERFORMANCE AND ASSOCIATED INVESTIGATIONS.

Berg, R.L., *U.S. Army Cold Regions Research and Engineering Laboratory. Report*, Sep. 1980, CR 80-19, p.53-100, ADA-094 497.
35-1770
ROADBEDS, CONSTRUCTION, PERMAFROST BENEATH ROADS, ENGINEERING, SEASONAL FREEZE THAW, THAW DEPTH, ROAD MAINTENANCE, DRAINAGE, PIPELINES, ACTIVE LAYER.

MP 1352

DISTRIBUTION AND PROPERTIES OF ROAD DUST ALONG THE NORTHERN PORTION OF THE HAUL ROAD.

Everett, K.R., *U.S. Army Cold Regions Research and Engineering Laboratory. Report*, Sep. 1980, CR 80-19, p.101-128, ADA-094 497.
35-1771
DUST, SEASONAL VARIATIONS, ROADS, TUNDRA, VEGETATION, ENVIRONMENTAL IMPACT, WIND FACTORS.

MP 1353

REVEGETATION AND RESTORATION INVESTIGATIONS.

Johnson, L.A., *U.S. Army Cold Regions Research and Engineering laboratory. Report*, Sep. 1980, CR 80-19, p.129-150, ADA-094 497.
35-1772
REVEGETATION, ROADS, CONSTRUCTION, SOIL EROSION, PIPELINES.

MP 1354

ANALYSIS OF NON-STEADY PLASTIC SHOCK WAVES IN SNOW.

Brown, R.L., *Journal of glaciology*, 1980, 25(92), p.279-287, 9 refs.
35-1822
SNOW MECHANICS, SHOCK WAVES, WAVE PROPAGATION, AVALANCHE TRIGGERING, EXPLOSION EFFECTS, SNOW DENSITY, PLASTIC PROPERTIES, ATTENUATION, PRESSURE, STRESSES.

MP 1355

ARCTIC ECOSYSTEM: THE COASTAL TUNDRA AT BARROW, ALASKA.

Brown, J., ed, US/IBP synthesis series, No.12, Stroudsburg, Pa., Dowden, Hutchinson and Ross, Inc., 1980, 571p., Refs. p.483-544. For individual chapters see 35-1930 through 35-1941.
Miller, P.C., ed, Tieszen, L.L., ed, Bunnell, F.L., ed.
35-1929
TUNDRA, ECOSYSTEMS, BIOMASS, NUTRIENT CYCLE, SOIL MICROBIOLOGY, ORGANIC SOILS, ANIMALS, CLIMATIC FACTORS, VEGETATION, UNITED STATES—ALASKA—BARROW.

MP 1356
COASTAL TUNDRA AT BARROW.
Brown, J., et al, Arctic ecosystem: the coastal tundra at Barrow, Alaska. Edited by J. Brown, P.C. Miller, L.L. Tieszen and F.L. Bunnell. Stroudsburg, Pa., Dowden, Hutchinson and Ross., Inc., 1980, p.1-29.
Everett, K.R., Webber, P.J., MacLean, S.F., Jr., Murray, D.F.
35-1930
TUNDRA, ECOSYSTEMS, ORGANIC SOILS, VEGETATION, CLIMATE, POLYGONAL TOPOGRAPHY, LAKES, ENVIRONMENTS.

MP 1357
ICE FOG SUPPRESSION IN ARCTIC COMMUNITIES.
McFadden, T., U.S. Army Cold Regions Research and Engineering Laboratory, SR 80-40, Building under cold climates and on permafrost; collection of papers from a U.S.-Soviet joint seminar, Leningrad, USSR, Dec. 1980, p.54-65, 18 refs.
35-1971
ICE FOG, FOG DISPERSAL, CHEMICAL ICE PREVENTION, VISIBILITY, TEMPERATURE EFFECTS, FILMS, AIR TEMPERATURE.

MP 1358
***DESIGN OF FOUNDATIONS IN AREAS OF* SIGNIFICANT FROST PENETRATION.**
Linell, K.A., et al, U.S. Army Cold Regions Research and Engineering Laboratory, SR 80-40, Building under cold climates and on permafrost; collection of papers from a U.S.-Soviet joint seminar, Leningrad, USSR, Dec. 1980, p.118-184, 48 refs.
Lobacz, E.F., Stevens, H.W.
35-1975
PERMAFROST BENEATH STRUCTURES, FOUNDATIONS, FREEZE THAW *CYCLES, PER*MAFROST HYDROLOGY, PERMAFROST DISTRIBUTION, FROZEN GROUND STRENGTH, FROST PENETRATION, SOIL MECHANICS, HEAT TRANSFER, SLOPE PROTECTION, DESIGN.

MP 1359
REGULATED SET CONCRETE FOR COLD WEATHER CONSTRUCTION.
Sayles, F.H., et al, U.S. Army Cold Regions Research and Engineering Laboratory, SR 80-40, Building under cold climates and on permafrost; collection of papers from U.S.-Soviet joint seminar, Leningrad, USSR, Dec. 1980, p.291-314, 8 refs.
Houston, B.J.
35-1983
COLD WEATHER CONSTRUCTION, WINTER CONCRETING, CONCRETE STRENGTH, CONCRETE HEATING, COMPRESSIVE PROPERTIES, *CEMENTS, CONCRETE CURRING*, CONCRETE FREEZING, COUNTERMEASURES, TEMPERATURE EFFECTS.

MP 1360
EXCAVATION OF FROZEN MATERIALS.
Moore, H.E., et al, U.S. Army Cold Regions Research and Engineering Laboratory, SR 80-40, Building under cold climates and on permafrost; collection of papers from U.S.-Soviet joint seminar, Leningrad USSR, Dec. 1980, p.323-345, 14 refs.
Sayles, F.H.
35-1985
COLD WEATHER CONSTRUCTION, EXCAVATION, FROZEN GROUND STRENGTH, EARTHWORK, CONSTRUCTION EQUIPMENT, MAINTENANCE, COLD WEATHER OPERATION, COLD WEATHER SURVIVAL, TEMPERATURE EFFECTS, FLOOD CONTROL.

MP 1361
MOISTURE GAIN AND ITS THERMAL CONSEQUENCE FOR COMMON ROOF INSULATIONS.
Tobiasson, W., et al, Conference on Roofing Technology, 5th April 19-20, 1979, Proceedings, ⌜1980⌝, p.4-16, 19 refs.
Ricard, J.
35-2053
ROOFS, THERMAL INSULATION, MOISTURE TRANSFER, WETTABILITY, THERMAL CONDUCTIVITY, TESTS.

This paper describes a method for determining the rate of moisture gain and the decay in thermal resistance caused by moisture in common roof insulations. Information on the rate of moisture gain for various insulations is tabulated (*Table III) and graphed (Figures* 4 *and* 5). The rate *of moisture* gain varies significantly with insulation type and wetting test boundary conditions. Graphs are presented to define the decay in thermal resistance of insulation samples at increasing moisture contents (Figures 6-11). Moisture significantly reduces the thermal resistance of most roof insulations.

MP 1362
REMOVAL OF ORGANICS BY OVERLAND FLOW.
Martel, C.J., et al, Proceedings of the National Seminar on Overland Flow Technology for Municipal Wastewater, Dallas, Texas, Sep. 16-18, 1980, ⌜1980⌝, 9p., 11 refs.
Bouzoun, J.R., Jenkins, T.F.
35-2052
WASTE TREATMENT, WATER TREATMENT, FLOODING, SEDIMENTATION, SEEPAGE, SOIL TEMPERATURE, SOIL CHEMISTRY, SLOPE ORIENTATION, LAND RECLAMATION.

MP 1363
WASTE HEAT UTILIZATION THROUGH SOIL HEATING.
McFadden, T., et al, *Canada. Environmental Protection Service. Economic and technical review. Report*, Oct.1980, EPS 3-WP-80-5, Symposium on Utilities Delivery in Northern Regions, 2nd, 1979. Proceedings, p.105-120, 13 refs.
Buska, J.
35-2112
WASTE DISPOSAL, HEAT SOURCES, HEAT RECOVERY, SOIL TEMPERATURE, HEATING, COOLING SYSTEMS, AGRICULTURE.

MP 1364
***NONSTEADY* ICE DRIFT IN THE STRAIT OF BELLE ISLE.**
Sodhi, D.S., et al, Sea ice processes and models. Edited by R.S. Pritchard, Seattle, University of Washington Press, 1980, p.177-186, 9 refs.
Hibler, W.D., III.
35-2168
SEA ICE, DRIFT, ICE WATER INTERFACE, BOUNDARY LAYER, MATHEMATICAL MODELS, VISCOUS FLOW.

The finite-element formulation of a *linear* viscous sea *ice* model has been presented. The temporal ice acceleration term is included in the *momentum* equations in order to compute nonsteady ice drift rates. This model is applied to the Strait of Belle Isle, where strong tidal streams move the pack ice back and forth. Using idealized sinusoidal variations of the tidal streams, it is found that the time lag between the water and the ice velocities is dependent upon the viscosity parameters. These results indicate that the ice is not drifting freely and the boundary layer near the shore affects the ice movement in the Strait. The viscosity parameters used in this study are small in order to simulate a reasonable time lag between the ice and water velocities. The high shearing near the shores necessitates low viscosities for proper simulation of the flow of pack ice in the Strait.

MP 1365
ICEBERG WATER: AN ASSESSMENT.
Weeks, W.F., *Annals of glaciology*, 1980, Vol.1, p.5-10, 27 refs.
35-2197
ICEBERGS, WATER SUPPLY, ICEBERG TOWING.

This review of the idea of using icebergs as a source of fresh water starts with a historical survey covering the period up to April 1980 and stresses how the approach to the subject has changed with time. Both the progress that *has been made* and the problems that have either just surfaced or never been adequately addressed are discussed. It is concluded that successful tows to Australia, clearly the most easily-reached potential delivery site, are possible *if* icebergs can retain their structural integrity during tows in high seas and *if* schemes can be developed for docking and processing. Tows *to sites* in the northern *hemisphere such* as Saudi Arabia and California are significantly more difficult and will remain so until an effective and operationally-realistic method is developed for isolating the iceberg from the warm sea-water that will be encountered during part of the tow. Whatever the ultimate resolution of the iceberg-water proposal may be, research stimulated by this idea has already resulted in a major improvement in our knowledge of the life and time of real icebergs in real oceans. (Auth.)

MP 1366
ACOUSTIC EMISSION RESPONSE OF SNOW.
St. Lawrence, W.F., *Journal of glaciology*, 1980, 26(94), p.209-216, 10 refs., In English with French and German summaries.
35-2363
SNOW ACOUSTICS, AVALANCHE TRIGGER*ING, AVALANCHE* FORMATION, STRESS STRAIN DIAGRAMS, RHEOLOGY, ULTRASONIC TESTS, MATHEMATICAL MODELS.

In this work a model of the ultrasonic acoustic emission response in snow is developed. The model derived considers the acoustic emission response in snow as a function of stress and strain. It is suggested that the acoustic emission activity in snow is a quantitative indication of the creep rupture taking place in the material. The governing differential equation is developed; an example is then presented that considers the applicability of this equation *to* the release *of certain types of avalanche.*

MP 1367
PROPAGATION OF STRESS WAVES IN ALPINE SNOW.
Brown, R.L., *Journal of glaciology*, 1980, 26(94), p.235-243, 8 refs., In English with French and German summaries.
35-2366
STRESSES, SHOCK WAVES, SNOW DENSITY, WAVE PROPAGATION, SNOW PHYSICS, PRESSURE, ANALYSIS (MATHEMATICS), ALPINE LANDSCAPES.

The propagation of pressure waves in low-density snow is investigated analytically to determine the variation of wave pressure and wave speed with density and frequency. The results show that, for pressure waves *that produce finite* volumetric deformations, both pressure jump across the wave and wave-speed increase with initial density and final density. The pressure jump was also found to increase with the wave frequency if other parameters were held constant, although the dependence on frequency is not as strong as the dependence on the initial and final *densities*. The relationship between pressure jump and frequency implies that high-frequency waves would tend to dissipate more quickly than lower-frequency waves, although like pressure, the attenuation rate would not be strongly frequency dependent.

MP 1368
THERMODYNAMICS OF SNOW METAMORPHISM DUE TO VARIATIONS IN CURVATURE.
Colbeck, S.C., *Journal of glaciology, 1980, 26*(94), p.291-301, 28 refs., In English with French and German summaries.
35-2372
METAMORPHISM (SNOW), THERMODYNAMICS, SNOW *THERMAL* PROPERTIES, HEAT TRANSFER, *VAPOR DIFFUSION*, TEMPERATURE GRADIENTS, ANALYSIS (MATHEMATICS), WET SNOW.

In the absence of imposed temperature gradients, the metamor*phism of dry snow is dominated* by the slow process *of* vapor diffusion between surfaces of different radii of curvature. This process is so slow in a seasonal snow cover (where temperatures normally change on the scale of hours or days) that vapor migration is usually dominated by the imposed temperature gradient. Thus radius of curvature contributes to but does not control metamorphism except for short periods in very fresh snow. As opposed to dry snow, liquid-saturated snow (i.e. pore space filled by the melt) is metamorphosed by heat flow arising from relatively large temperature differences among the particles. Grain growth *in* liquid-saturated snow is rapid because of the large temperature differences at nearly constant liquid pressure. In wet snow with low liquid content (2-5% by volume), grain growth is dominated by vapor diffusion (as in *dry* snow) so grain growth is much slower than under conditions of liquid saturation.

MP 1369
STUDY OF OCEANIC BOUNDARY-LAYER CHARACTERISTICS INCLUDING INERTIAL OSCILLATION AT THREE DRIFTING STATIONS IN THE ARCTIC OCEAN.
McPhee, M.G., *Journal of physical oceanography*, June 1980, 10(6), p.870-884, 22 refs.
35-1059
BOUNDARY LAYER, DRIFT, PACK ICE, OCEAN CURRENTS, OSCILLATIONS, WIND FACTORS, DRIFT STATIONS.

MP 1370
CONSTITUTIVE RELATION FOR THE DEFORMATION OF SNOW.
St. Lawrence, W.F., et al, *Cold regions science and technology*, Jan. 1981, 4(1), p.3-14, 16 refs.
Lang, T.E.
35-2414
SNOW DEFORMATION, SNOW COVER STRUCTURE, STRESS STRAIN DIAGRAMS, SNOW COMPRESSION, VELOCITY, SNOW ACOUSTICS, ANALYSIS (MATHEMATICS).

In this paper a constitutive equation which describes the uniaxial deformation of snow is developed. The basic assumption underlying this work is that the stress-strain response can be derived by considering the structure of the material. The equation which describes the plastic portion of the deformation is developed by considering the relationship between three fundamental variables: the mean spacing between ice grains, the relatative velocity between grains, and the fraction *of* the total number of grains which participate in the deformation process. The mean distance between ice grains is determined by a stereological investigation of the snow structure, and the velocity component is found by empirically characterizing the relaxation of the snow. To determine the mobility of the ice grains acoustic emission data are used. An equation describing the pattern of acoustic emissions for constant rates of deformation is derived and applied to a number of tests. Combining the above variables produces a compressive and tensile constitutive equation which reflects the behavior of the snow under both uniaxial deformations.

MP 1371
CYCLIC LOADING AND FATIGUE IN ICE.

Mellor, M., et al, *Cold regions science and technology,* Jan. 1981, 4(1), p.41-53, 4 refs.
Cole, D.M.
35-2417
ICE CRYSTALS, DYNAMIC LOADS, ICE STRENGTH, STRESS STRAIN DIAGRAMS, FATIGUE (MATERIALS), ICE CREEP, TIME FACTOR.

Isotropic polycrystalline ice was subjected to cyclic loading in uniaxial compression at -5C, with stress limits 0-2 and 0-3 MPa, and frequencies in the range 0.043 to 0.5 Hz. Stress-strain records showed hysteresis loops progressing along the strain axis at non-uniform rates. The effective secant modulus, which was about half the true Young's modulus, decreased during the course of a test. The elastic strain amplitude and the energy dissipated during a loading cycle both increased with increase of time and plastic strain. Strain-time records gave mean curves which were identical in form to classical constant stress creep curves, with a small cyclic alternation of recoverable strain about the mean curve. The results of the tests suggest that maximum resistance under compressive cyclic loading occurs at an axial plastic strain of about 1%, which is essentially the same as the failure strain for ductile yielding under constant stress and under constant strain-rate.

MP 1372
COLD REGIONS SCIENCE AND TECHNOLOGY BIBLIOGRAPHY.

Cummings, N.H., *Cold regions science and technology,* Jan. 1981, 4(1), p.73-75.
35-2420
BIBLIOGRAPHIES, GLACIOLOGY, PERMAFROST, HYDROLOGY, ENGINEERING GEOLOGY, METEOROLOGY.

MP 1373
COLD CLIMATE UTILITIES DELIVERY DESIGN MANUAL.

Smith, D.W., et al, *Canada. Environmental Protection Service. Report,* 1979, EPS 3-WP-79-2, c300 leaves, Numerous refs. passim.
Reed, S.C.
33-4406
MANUALS, UTILITIES, NATURAL RESOURCES, WATER SUPPLY, WASTE DISPOSAL, WATER TREATMENT, WATER PIPELINES, PIPELINE FREEZING, THERMAL INSULATION.

MP 1374
PROCEEDINGS 1972 TUNDRA BIOME SYMPOSIUM.

International Biological Programme. Tundra Biome, 1972, 211p., For selected papers see 31-2031 through 31-2049. Symposium held at Lake Wilderness Center, University of Washington 3-5 April, 1972.
Brown, J., coord, Bowen, S., ed.
31-2030
TUNDRA VEGETATION, TUNDRA SOILS, SOIL CHEMISTRY, DECOMPOSITION.

MP 1375
CO2 EXCHANGE IN THE ALASKAN ARCTIC TUNDRA: METEOROLOGICAL ASSESSMENT BY THE AERODYNAMIC METHOD.

Coyne, P.I., et al, 1972 Tundra Biome Symposium, Lake Wilderness Center, Univ. of Washington, July 1972. Proceedings, 1972, p.36-39, 4 refs.
Kelley, J.J.
31-2036
TUNDRA VEGETATION, TURBULENT EXCHANGE, CARBON DIOXIDE.

MP 1376
COMPARATIVE INVESTIGATION OF PERIODIC TRENDS IN CARBOHYDRATE AND LIPID LEVELS IN ARCTIC AND ALPINE PLANTS.

McCown, B.H., et al, 1972 Tundra Biome Symposium, Lake Wilderness Center, Univ. of Washington, July 1972. Proceedings, 1972, p.40-45, 3 refs.
Tieszen, L.L.
31-2037
ARCTIC LANDSCAPES, CELL MORPHOLOGY, LIPIDS, CARBOHYDRATES.

MP 1377
DELINEATION AND ENGINEERING CHARACTERISTICS OF PERMAFROST BENEATH THE BEAUFORT SEA.

Sellmann, P.V., et al, Environmental assessment of the Alaskan continental shelf. Vol. 12. Geology. Principal investigators' reports for the year ending March 1976, Boulder, Colorado, Environmental Research Laboratories, 1976, p.391-408, Includes preliminary bibliography of Soviet literature on subsea permafrost, p.404-408.
Berg, R.L., Brown, J., Blouin, S.E., Chamberlain, E.J., Iskandar, A., Ueda, H.T.
31-361
RESEARCH PROJECTS, OFFSHORE DRILLING, SUBSEA PERMAFROST, BEAUFORT SEA.

MP 1378
ANTARCTIC SEA ICE DYNAMICS AND ITS POSSIBLE CLIMATIC EFFECTS.

Ackley, S.F., et al, *Arctic Ice Dynamics Joint Experiment. AIDJEX bulletin,* Sep. 1976, No.33, p.53-76, 20 refs.
Keliher, T.E.
31-448
SEA ICE, ICE COVER EFFECT, CLIMATE, SPACEBORNE PHOTOGRAPHY, PHOTOINTERPRETATION, HEAT LOSS, MICROWAVES.

Ice extent charts prepared from satellite images by the U.S. Naval Fleet Weather Facility and passive microwave emission data from the Nimbus V satellite were examined for the winters of 1973 and 1974 to determine the variation between the two years of the heat loss by the atmosphere because of variations in sea ice extent and concentration. The microwave data indicate that most of the area within the ice edge is less than 80% ice covered even during the coldest part of the year, probably because of ocean currents, waves, and swell, and convergence and divergence in the atmospheric forcing fields. Since the winter heat and moisture transports from open water are about two orders of magnitude larger than from an equal area of sea ice, even small areas of open water within the ice edge can greatly affect the energy exchange. These new data are compared with the assumption of 100% ice cover within the ice edge and with previously assumed mean values for the total area covered by ice in calculating the heat lost by the atmosphere during the winter period in high southern latitudes. A rapid decrease in sea ice extent observed during the winter of 1973 is correlated with a nearly real-time adjustment by the atmosphere to the change in the heat loss caused by the removal of the ice. This example indicates that sea ice dynamics is influential not only in long-term climate, but in synoptic-scale weather patterns as well.

MP 1379
MISGIVINGS ON ISOSTATIC IMBALANCE AS A MECHANISM FOR SEA ICE CRACKING.

Ackley, S.F., et al, *Arctic Ice Dynamics Joint Experiment. AIDJEX bulletin,* Sep. 1976, No.33, p.85-94, 12 refs.
Hibler, W.D., III, Kugzruk, F.K.
31-450
SEA ICE, ICE CRACKS, ISOSTASY, ICE PHYSICS, ICE DENSITY.

In the AIDJEX ice pack model the formation mechanisms for ice cracks are ignored because of the many processes by which cracks may form. The authors question this concept and particularly the mechanism of isostatic imbalance. They cite the Young's modulus used in the AIDJEX model as being not representative of sea ice and that beam experiments in static tests lead them to question the validity of a purely elastic analysis.

MP 1380
DYNAMICS OF NEAR-SHORE ICE.

Weeks, W.F., et al, Environmental assessment of the Alaskan continental shelf; Vol. 14, Ice. Principal Investigators' reports for the year ending March 1976, Boulder, Colorado, Environmental Research Laboratories, 1976, p.9-34, 16 refs. Includes appendix No. 1 by A. Kovacs and A.J. Gow, Some characteristics of grounded floebergs near Prudhoe Bay, Alaska.
Kovacs, A., Gow, A.J.
31-628
FAST ICE, ICE MECHANICS, ICE FLOES, ICE ISLANDS, SEA ICE, DRIFT, RADAR ECHOES, BOTTOM ICE, ICEBERGS, BOTTOM TOPOGRAPHY, UNITED STATES--ALASKA—PRUDHOE BAY.

MP 1381
INVESTIGATION OF ICE ISLANDS IN BABBAGE BIGHT.

Kovacs, A., et al, Creare, Inc. Technical note 118, Hanover, New Hampshire, Creare, Inc., 1971, 46 leaves, 24 refs.
Mellor, M.
31-820
SEA ICE, ICE ISLANDS, ICE STRUCTURE, SUBGLACIAL OBSERVATIONS, ICE DENSITY, GROUNDED ICE.

MP 1382
RHEOLOGICAL IMPLICATIONS OF THE INTERNAL STRUCTURE AND CRYSTAL FABRICS OF THE WEST ANTARCTIC ICE SHEET AS REVEALED BY DEEP CORE DRILLING AT BYRD STATION.

Gow, A.J., et al, *Geological Society of America. Bulletin,* Dec. 1976, 87(12), p.1665-1677, 51 refs.
Williamson, T.
31-1071
ICE SHEETS, ICE CRYSTAL STRUCTURE, RHEOLOGY, ICE DEFORMATION, ANTARCTICA—BYRD STATION.

Crystalline textures and fabrics of ice cores from the 2,164-m-thick ice sheet at Byrd Station, reveal the existence of an anisotropic ice sheet. A gradual but persistent increase in the c-axis preferred orientation of the ice crystals was observed between the surface and a depth of 1,200 m. This progressive growth of an oriented crystal fabric is accompanied by a twentyfold increase in crystal size between 56 and 500 m, followed by virtually no change in crystal size between 600 and 1,200 m depth. A broad vertical clustering of c axes develops by 1,200 m. Between 1,200 and 1,300 m, the structure transforms into a fine-grained mosaic of crystals with their basal glide planes now oriented substantially within the horizontal. This highly oriented fine-grained structure, which persists to 1,800 m depth, is compatible only with a strong horizontal shear deformation in this part of the ice sheet. Rapid transformation from single- to multiple-maximum fabrics occurs below 1,800 m. This transformation, accompanied also by the growth of very large crystals, is attributed to the overriding effect of relatively high temperatures in the bottom layers of old ice at Byrd Station rather than to a significant decrease in stress. The zone of single-maximum fabrics between 1,200 and 1,800 m also contains numerous layers of volcanic dust which appear to be actively associated with shearing in the ice sheet. Some slipping of ice along the bed rock seems likely at Byrd Station. The textures and fabrics of the ice indicate that plastic deformation (intracrystalline glide) in the zone of strong single-maximum fabrics and movement of ice along discrete shear planes situated well above bed rock are also major contributors to the flow of the ice sheet. (Auth. mod.)

MP 1383
ECOLOGICAL AND ENVIRONMENTAL CONSEQUENCES OF OFF-ROAD TRAFFIC IN NORTHERN REGIONS.

Brown, J., Surface Protection Seminar, Anchorage, Alaska, Jan. 19-22, 1976. Proceedings. Edited by M.N. Evans, Anchorage, Alaska, Bureau of Land Management, Aug. 1976, p.40-53, 19 refs.
31-1088
PERMAFROST PRESERVATION, ARCTIC LANDSCAPES, TUNDRA, ALL TERRAIN VEHICLES, PROTECTION, ENVIRONMENTAL IMPACT, REVEGETATION, HUMAN FACTORS, THAW DEPTH, SOIL TRAFFICABILITY, VEGETATION PROTECTION, DAMAGE, GROUND THAWING.

The consequences of off-road activities depend on when the activity occurs (summer vs. winter), the degree of impact, the nature and response of the underlying permafrost to the surface modification, and the rate at which the damaged environment will recover. Regulations based on a knowledge of the environmental variables and how they react to impact are required to minimize impact in these areas which are sensitive to human and natural perturbations. We should not underestimate the requirement for good environmental information and adequate resource mapping as first, necessary steps.

MP 1384
VEHICLE FOR THE FUTURE.

Slaughter, C.W., Surface Protection Seminar, Anchorage, Alaska, Jan. 19-22, 1976. Proceedings. Edited by M.N. Evans, Anchorage, Alaska, Bureau of Land *Management, Aug. 1976, p.272-279, 5 refs.*
31-1111
AIR CUSHION VEHICLES, ARCTIC LANDSCAPES, DAMAGE, ENVIRONMENTAL IMPACT, GROUND THAWING.

The U.S. Army Cold Regions Research and Engineering Laboratory (USACRREL) has evaluated effects of air-cushion *vehicles (ACV's) on surfaces on Alaska's Arctic Slope.* Most ACV surface impact was from abrasion by the vehicle skirts rather than air flow, which merely removed loose litter. Vehicle speed and surface micro-relief both affected surface damage. The ACV damaged the surface less than other vehicles tested and caused less accelerated soil thaw; trails over which the ACV passed recovered faster. Size, payload, cost, terrain characteristics, and availability are among the conditions that determine the kind of vehicle needed for a particular job. No single vehicle, now or in the future, can fill all the necessary and desirable requirements and cause little surface damage. Other aspects of off-road travel, such as route selection, trail improvement and protection, operator sensitivity, and access priorities also affect surface damage. More important than vehicle design and selection are the management decisions to be made concerning regulation of off-road travel.

MP 1385

CHEMISTRY OF INTERSTITIAL WATER FROM SUBSEA PERMAFROST, PRUDHOE BAY, ALASKA.

Iskandar, I.K., et al, International Conference on Permafrost, 3rd, Edmonton, Alberta, Canada, July 10-13, 1978. Proceedings. Vol.1, Ottawa, National Research Council of Canada, 1978, p.92-98, With Russian and French summaries. 20 refs.

Osterkamp, T.E., Harrison, W.D.

32-3676

WATER CHEMISTRY, SUBSEA PERMAFROST, INTERSTITIAL WATER.

MP 1386

ANTARCTIC SOIL STUDIES USING A SCANNING ELECTRON MICROSCOPE.

Kumai, M., et al, International Conference on Permafrost, 3rd, Edmonton, Alberta, Canada, July 10-13, 1978. Proceedings. Vol.1, Ottawa, National Research Council of Canada, 1978, p.106-112, With Russian and French summaries. 12 refs.

Anderson, D.M., Ugolini, F.C.

32-3678

ELECTRON MICROSCOPY, CRYOGENIC SOILS, MORAINES, SOIL COMPOSITION, GRAIN SIZE, WEATHERING, ANTARCTICA—VICTORIA LAND.

The textures of morainic soils from southern Victoria Land were investigated, using a scanning electron microscope fitted with an energy dispersive X-ray analyzer. Electron micrographs of soil grains from lower Wright Valley showed sharp edges and smooth surfaces, indicating a low degree of mechanical and chemical weathering. The soil grains were 11% quartz and 4% magnetite. Chlorides were found on 7% of the soil grains. By contrast, electron micrographs of soil grains from the Beacon Valley showed rounded grains indicating a high degree of mechanical and chemical weathering. The soil grains were 20% quartz. Rhombohedral crystals CaSO4 were found on 60% of the soil grains. Chlorides were found on 30% of the soil grains. Because of the high degree of weathering, it was concluded that the morainic soils from the Beacon Valley are much older than those of the lower Wright Valley.

MP 1387

COST OF LAND TREATMENT SYSTEMS.

Reed, S.C., et al, *U.S. Environmental Protection Agency. Technical report,* Sep. 1979, EPA-430/9-75-003, 135p., 45 refs.

Crites, R.W., Thomas, R.E., Hais, A.B.

35-2464

SEEPAGE, WASTE TREATMENT, SEWAGE TREATMENT, WATER TREATMENT, COST ANALYSIS, FLOW RATE, SURFACE DRAINAGE, LAND RECLAMATION.

Cost information for planning is presented for the major land treatment concepts including slow rate, rapid infiltration and overland flow. Cost categories include land, preapplication treatment, transmission, storage, land application, and recovery of renovated water.

MP 1388

MEASURING BUILDING R-VALUES FOR LARGE AREAS.

Flanders, S.N., et al, *Society of Photo-Optical Instrumentation Engineers. Proceedings,* 1981, Vol.254, p.137-138.

Marshall, S.J.

35-2463

BUILDINGS, WALLS, THERMAL REGIME, HEAT FLUX, SURFACE TEMPERATURE, TEMPERATURE MEASUREMENT.

A method is being developed for measuring the R-values of large areas of building envelopes. This is a summary of progress to date. Temperature extremes on the building surface are located with an infrared videocamera, the R-values at those locations determined with contact thermal sensors and R-values interpolated for all other locations from the thermograms.

MP 1389

HEALTH ASPECTS OF LAND TREATMENT.

Reed, S.C., Cincinnati, Oh., U.S. Environmental Protection Agency, 1979, 43p., Prepared for Seminar on Land Treatment of Municipal Wastewater Effluents, June 1979. 52 refs.

35-2493

WASTE TREATMENT, POLLUTION, HEALTH, WATER TREATMENT, LAND RESTORATION.

MP 1390

HAND-HELD INFRARED SYSTEMS FOR DETECTING ROOF MOISTURE.

Tobiasson, W., et al, Symposium on Roofing Technology, Gaithersburg, Md., Sep. 21-23, 1977. Proceedings, ⌈1977⌉, p.261-271, 4 refs.

Korhonen, C., Van den Berg, A.

35-2494

ROOFS, MOISTURE DETECTION, MOISTURE METERS, INFRARED RECONNAISSANCE, THERMAL INSULATION.

MP 1391

LANDSAT DIGITAL ANALYSIS OF THE INITIAL RECOVERY OF BURNED TUNDRA AT KOKOLIK RIVER, ALASKA.

Hall, D.K., et al, *Remote sensing of environment,* 1980, No.10, p.263-272, 8 refs.

Ormsby, J.P., Johnson, L.A., Brown, J.

35-2462

TUNDRA, FIRES, ENVIRONMENTAL IMPACT, REMOTE SENSING, ANALYSIS (MATHEMATICS), LANDSAT, REVEGETATION.

MP 1392

LAND DISPOSAL: STATE OF THE ART.

Reed, S.C., National Symposium on Ultimate Disposal of Wastewaters and Their Residuals, Durham, N.C., April 26-27, 1973. Proceedings. Edited by F.E. McJunkin and P.A. Vesilind, Raleigh, North Carolina State University, 1973, p.229-261, 42 refs.

35-2469

WASTE DISPOSAL, WATER TREATMENT, ENVIRONMENTAL PROTECTION, SEEPAGE, CLIMATIC FACTORS, FLOW RATE, VEGETATION, AEROSOLS, HEALTH.

MP 1393

WINDOW PERFORMANCE IN EXTREME COLD.

Flanders, S.N., et al, Specialty Conference on the Northern Community, Seattle, Wa., Apr. 8-10, 1981. Proceedings. Edited by T.S. Vinson, New York, American Society of Civil Engineers, 1981, p.396-408, 2 refs.

Buska, J., Barrett, S.

35-2514

WINDOWS, COLD WEATHER CONSTRUCTION, WEATHERPROOFING, MOISTURE, CLIMATIC FACTORS, COUNTERMEASURES.

Extreme cold causes heavy buildup of frost, ice and condensation on many windows. It also increases the incentive for improving the airtightness of windows in Alaska to avoid moisture accumulation in homes and barracks. We base our conclusions on a two-year study of Alaskan military bases that included recording humidity and temperature data, observing moisture accumulation on windows and measuring airtightness with a fan pressurization device. Our study shows that tightening Alaskan windows to permit only 30% of the air leakage allowed to current American standards for window airtightness is economically attractive.

MP 1394

AQUACULTURE FOR WASTEWATER TREATMENT IN COLD CLIMATES.

Reed, S.C., et al, Specialty Conference on the Northern Community, Seattle, Wa., Apr. 8-10, 1981. Proceedings. Edited by T.S. Vinson, New York, American Society of Civil Engineers, 1981, p.482-492, 12 refs.

Bouzoun, J.R.

35-2519

WASTE TREATMENT, WATER TREATMENT, PLANTS (BOTANY).

Aquaculture systems for wastewater treatment often include plants, finned fish, animals and microorganisms in various combinations in aquatic settings such as ponds, marshes, bogs and other forms of wetlands. Natural settings have often been used in the past but there is a trend toward constructed systems which permit more reliable management at higher rates of treatment. This paper evaluates the potential for application of aquaculture concepts for wastewater treatment in cold climates. Constructed wetlands and the enclosed high rate processes offer the most promise of the concepts considered. Systems based on plants are more efficient, require less area and are easier to control than concepts involving higher forms of animals.

MP 1395

WINTER AIR POLLUTION AT FAIRBANKS, ALASKA.

Coutts, H.J., et al, Specialty Conference on the Northern Community, Seattle, Wa., Apr. 8-10, 1981. Proceedings. Edited by T.S. Vinson, New York, American Society of Civil Engineers, 1981, p.512-528, 16 refs.

Jenkins, T.F.

35-2522

AIR POLLUTION, CHEMICAL ANALYSIS, ENVIRONMENTAL IMPACT, MOTOR VEHICLES, HUMAN FACTORS, STANDARDS.

Air quality measurements were made for both gases and particulates at several locations near Fairbanks, Alaska, during winter. The results indicated that carbon monoxide levels downtown frequently exceeded air quality standards and were significantly elevated at more rural locations up to 22 km from the downtown area. High levels were found to be associated with temperature inversions. Nitric oxide levels were measured and found to range from less than 50 to over 500 parts per billion (ppb) downtown. Levels of 1 to 68 ppb were measured in a more rural location. The major source of both CO and NO at Fairbanks was found to be auto exhaust. Levels of particulate lead in the downtown area were found to exceed Federal Standard for all 4 winter months. Lead levels at the more rural site were only about one-tenth those of downtown and did not exceed standards.

MP 1396

ICE FORCE MEASUREMENT ON THE YUKON RIVER BRIDGE.

McFadden, T., et al, Specialty Conference on the Northern Community, Seattle, Wa., Apr. 8-10, 1981. Proceedings. Edited by T.S. Vinson, New York, American Society of Civil Engineers, 1981, p.749-777, 11 refs.

Haynes, D., Burdick, J., Zarling, J.

35-2536

ICE BREAKUP, ICE PRESSURE, ICE LOADS, IMPACT STRENGTH, BRIDGES, ICE COVER STRENGTH, LOADS (FORCES), ICE COVER THICKNESS, RADAR ECHOES.

The Alaskan Projects Office of Cold Regions Research and Engineering Laboratory has been studying the forces imposed on the Yukon River bridge by ice during breakup. The study involved four consecutive breakups from 1977 thru 1980. Forces have been measured using load cells mounted on the front of the number 5 pier to intercept the ice as it strikes the pier. Accelerometers mounted on piers number 4 and 5 were used to measure the response of the pier to the ice impacts. Calibration procedures were employed to determine a transfer function which relates the accelerations to the applied forces. Ice thicknesses were measured using short pulse radar techniques. River ice damaged or destroyed the first generation load cell designs, but some useful data was obtained before failure. Radar techniques show some promise for the measurement of ice thicknesses during breakup.

MP 1397

ANALYSIS OF VELOCITY PROFILES UNDER ICE IN SHALLOW STREAMS.

Calkins, D.J., et al, Workshop on Hydraulic Resistance of River Ice, Burlington, Ontario, Sep. 23-24, 1980. Proceedings. Edited by G. Tsang and S. Beltaos, Burlington, Ontario, National Water Research Institute, 1981, p.94-111, 6 refs.

Deck, D.S., Martinson, C.R.

35-2545

STREAM FLOW, ICE COVER EFFECT, FLOW RATE, SHEAR STRESS, SURFACE ROUGHNESS, ICE BOTTOM SURFACE, PROFILES.

MP 1398

HARNESSING FRAZIL ICE.

Perham, R.E., Workshop on Hydraulic Resistance of River Ice, Burlington, Ontario, Sep. 23-24, 1980. Proceedings. Edited by G. Tsang and S. Beltaos. Burlington, Ontario, National Water Research Institute, 1981, p.227-237.

35-2554

FRAZIL ICE, ICE CONTROL, RIVER ICE, RIVER FLOW, FLOW RATE, HYDRODYNAMICS, ICE FORMATION.

The techniques for analyzing velocity profiles should be carefully considered in shallow streams where the flow depth is less than 1 m. The two procedures, a) mean and maximum velocity determinations and b) intercept evaluation of log (depth)-velocity plots, yield different results for the various resistance coefficients and shear stress values. The mean-max-velocity method generally predicts higher values than the other and is recommended for shallow streams. The minimum distance from a boundary to the position of maximum velocity for a good velocity profile appears to be roughly 15 to 20 cm with a 5 cm diameter sensor.

MP 1399

LAND TREATMENT OF WASTEWATERS FOR RURAL COMMUNITIES.

Reed, S.C., et al, Rural Environmental Engineering Conference, Warren Vt., Sept. 26-28, 1973. Proceedings. Water pollution control in low density areas. Edited by W.J. Jewell, Hanover, N.H., University Press of New England, 1975, p.23-39, 7 refs.

Buzzell, T.D.

35-2568

WASTE TREATMENT, WATER POLLUTION, SEEPAGE, SURFACE DRAINAGE, IRRIGATION, DESIGN CRITERIA, COST ANALYSIS.

MP 1400
RATIONAL DESIGN OF OVERLAND FLOW SYSTEMS.
Martel, C.J., et al, National Conference on Environmental Engineering, New York, July 8-10, 1980. Proceedings, New York, American Society of Civil Engineers, 1980, p.114-121, 9 refs.
Adrian, D.D., Jenkins, T.F., Peters, R.E.
35-2571
WASTE TREATMENT, WATER TREATMENT, FLOODING, HYDRAULICS, GRASSES, SLOPES, RUNOFF, SEEPAGE, TIME FACTOR, DESIGN.

MP 1401
ENERGY AND COSTS FOR AGRICULTURAL REUSE OF WASTEWATER.
Sletten, R.S., et al, National Conference on Environmental Engineering, New York, July 8-10, 1980. Proceedings, New York, American Society of Civil Engineers, 1980, p.339-346, 9 refs.
Reed, S.C., Middlebrooks. E.J.
35-2572
WATER TREATMENT, WASTE TREATMENT, LAND RECLAMATION, SEEPAGE, AGRICULTURE, FLOODING, SANITARY ENGINEERING, COST ANALYSIS.

MP 1402
FORAGE GRASS GROWTH ON OVERLAND FLOW SYSTEMS.
Palazzo, A.J., et al, National Conference on Environmental Engineering, New York, July 8-10, 1980. Proceedings, New York, American Society of Civil Engineers, 1980, p.347-354, 16 refs.
Martel, C.J., Jenkins, T.F.
35-2573
WASTE TREATMENT, WATER TREATMENT, FLOODING, IRRIGATION, GRASSES, CHEMICAL COMPOSITION, LAND RECLAMATION, SLOPES, SANITARY ENGINEERING.

MP 1403
SPRAY APPLICATION OF WASTEWATER EFFLUENT IN A COLD CLIMATE: PERFORMANCE EVALUATION OF A FULL-SCALE PLANT.
Cassell, E.A., et al, National Conference on Environmental Engineering, New York, July 8-10, 1980. Proceedings, New York, American Society of Civil Engineers, 1980, p.620-626, 7 refs.
Meals, D.W., Bouzoun, J.R., Martel, C.J., Bronson, W.A.
35-2574
WASTE TREATMENT, WATER TREATMENT, CHEMICAL COMPOSITION, LAND RECLAMATION, COLD WEATHER PERFORMANCE, HYDROLOGY, SEASONAL VARIATIONS.

MP 1404
HEALTH ASPECTS OF WATER REUSE IN CALIFORNIA.
Reed, S.C., *American Society of Civil Engineers. Environmental Engineering Division. Journal,* Apr. 1979, 105(EE2), p.434-435, Discussion of a paper by J. Crook, Ibid., Aug. 1978, Proc. paper No. 13928.
35-2580
WASTE TREATMENT, WATER TREATMENT, WATER POLLUTION, BACTERIA, HEALTH, AEROSOLS, LAND RECLAMATION.

MP 1405
TUNDRA AND ANALOGOUS SOILS.
Everett, K.R., et al, Tundra ecosystems: a comparative analysis. Edited by L.C. Bliss, et al. International Biological Programme 25, Cambridge University, 1981, p.139-179, Refs. p.176-179.
Vasil'evskaia, V.D., Brown, J., Walker, B.D.
35-2705
TUNDRA, SOIL FORMATION, GEOMORPHOLOGY, PERMAFROST, SEASONAL FREEZE THAW, VEGETATION, CLIMATIC FACTORS, ECOSYSTEMS, SOIL COMPOSITION, SOUTH SHETLAND ISLANDS, MACQUARIE ISLAND, SOUTH GEORGIA.
Properties of Arctic, sub-Arctic, sub-Antarctic, mountain and maritime tundra soils are described. Climate, seasonal freeze thaw regime of tundra soils, soil composition, geomorphology and vegetation are discussed. Data on soil profiles *for the South Shetland Is., Macquarie I. and South Georgia* are tabulated.

MP 1406
MUNICIPAL SLUDGE MANAGEMENT: ENVIRONMENTAL FACTORS.
Reed, S.C., ed, *U.S. Environmental Protection Agency. Office of Water Program Operations. Technical bulletin,* Oct. 1977, EPA 430/9-77-004, Var. p., 6 refs.
35-2715
SLUDGES, WASTE DISPOSAL, WASTE TREATMENT, WATER TREATMENT, LAND RECLAMATION, ENVIRONMENTAL PROTECTION, BACTERIA, LEGISLATION, AGRICULTURE.

MP 1407
USE OF PILING IN FROZEN GROUND.
Crory, F.E., American Society of Civil Engineers. National Convention, Session No.3, Portland, Oregon, Apr. 14-18, 1980. Cold regions engineering, Portland, Oregon, 1980, 21 p., 24 refs.
35-2711
PILE DRIVING, FOUNDATIONS, FROZEN GROUND STRENGTH, COLD WEATHER CONSTRUCTION, PERMAFROST DEPTH, PILE LOAD TESTS, BEARING STRENGTH, FROST HEAVE, HEAT TRANSFER.

MP 1408
ROOFS IN COLD REGIONS.
Tobiasson, W., American Society of Civil Engineers. National Convention, Session No.3, Portland, Oregon, Apr. 14-18, 1980. Cold regions engineering, Portland, Oregon, 1980, 21p., 10 refs.
35-2713
ROOFS, WATERPROOFING, COLD WEATHER CONSTRUCTION, INSULATION, MOISTURE, CLIMATIC FACTORS.

MP 1409
ANALYSIS OF WATER IN THE MARTIAN REGOLITH.
Anderson, D.M., et al, *Journal of molecular evolution,* 1979, Vol.14, p.33-38, 9 refs.
Tice, A.R.
35-2756
MARS (PLANET), SOIL WATER, ADSORPTION, WATER VAPOR, THERMODYNAMICS, SOIL MICROBIOLOGY, TEMPERATURE EFFECTS.
One of the scientific objectives of the Viking Mission to Mars was to accomplish an analysis of water in the Martian regolith. The analytical scheme originally envisioned was severely compromised in the latter stages of the Lander instrument package design. The presence of a duricrust at one of the Lander sites is taken as possible evidence for the presence of hygroscopic minerals on Mars. The demonstrated presence of atmospheric water vapor and thermodynamic calculations lead to the belief that adsorbed water could provide a relatively favorable environment for endolithic organisms on Mars similar to types recently discovered in 'he dry antarctic deserts.

MP 1410
ESTIMATION OF HEAT AND MASS FLUXES OVER ARCTIC LEADS.
Andreas, E.L., *Monthly weather review,* Dec. 1980, 108(12), p.2057-2063, 26 refs.
35-2754
POLYNYAS, SEA ICE, HEAT TRANSFER, MASS TRANSFER, TURBULENT EXCHANGE, HEAT FLUX, ANALYSIS (MATHEMATICS).
Recent work on the turbulent transfer of scalar quantities following a step increase in the surface value of the scalar is directly applicable to the problem of estimating heat and mass transfer from Arctic leads in winter. With the transfer relations, turbulent fluxes can be computed from standard meteorological observables; and from the Nusselt number equality, partitioning of the turbulent fluxes can be evaluated —in particular, the partitioning of the heat flux between sensible and latent components.

MP 1411
PILES IN PERMAFROST FOR BRIDGE FOUNDATIONS.
Crory, F.E., et al, ASCE Structural Engineering Conference, Seattle, Washington, May 8-12, 1967. Conference preprint 522, ⌈1967⌉, 41p., 6 refs.
Matlock, C.S.
35-2753
PERMAFROST BENEATH RIVERS, PILE DRIVING, FOUNDATIONS, BRIDGES, PERMAFROST PRESERVATION, BEARING STRENGTH, SETTLEMENT (STRUCTURAL), SOIL TEMPERATURE, DESIGN CRITERIA, FROST HEAVE, COUNTERMEASURES, STREAMS.
This cooperative research study has focused considerable attention on the ground temperatures existing beneath and adjacent to streams in permafrost areas. An appreciation of the changes in the thaw area beneath the stream, both at the time of construction and for the life of the structure, is essential to proper siting of the bridge foundation. Location of abutments and piers outside of the potential thaw zone of the stream, or penetration at the most advantageous points to depths sufficient to achieve the required bearing capacity, is essential. The design of piles based on depth of embedment, adfreeze strength or dynamic driving formulas in frozen soils is of little value if the permafrost condition is later destroyed. Emphasis must be placed on retaining the original permafrost conditions and providing for frost action.

MP 1412
UNFROZEN WATER CONTENTS OF SUBMARINE PERMAFROST DETERMINED BY NUCLEAR MAGNETIC RESONANCE.
Tice, A.R., et al, International Symposium on Ground Freezing, 2nd, Trondheim, Norway, June 24-26, 1980. Preprints, Trondheim, University, Norwegian Institute of Technology, 1980, p.400-412, 10 refs.
Anderson, D.M., Sterrett, K.F.
36-32
SUBSEA PERMAFROST, UNFROZEN WATER CONTENT, MELTING POINTS, NUCLEAR MAGNETIC RESONANCE, TEMPERATURE EFFECTS, TEMPERATURE MEASUREMENT, DRILL CORE ANALYSIS.
Prior work resulted in the development of techniques to measure the unfrozen water contents in frozen soils by nuclear magnetic resonance (NMR). It has been demonstrated that NMR is a promising new method for the determination of phase composition (the measurement of unfrozen water content as a function of temperature) which circumvents many of the limitations inherent in the adiabatic and isothermal calorimetric techniques. The NMR technique makes it possible, in a non-destructive, non-intrusive way, to explore hysteresis by determining both cooling and warming curves. Corrections are made for dissolved paramagnetic impurities which have the effect of increasing the signal intensity at decreasing temperatures. The results demonstrate that NMR techniques can be effectively utilized both at and below the melting point of ice in frozen soils and that accurate melting points (freezing point depressions) can be determined.

MP 1413
COST-EFFECTIVE USE OF MUNICIPAL WASTEWATER TREATMENT PONDS.
Reed, S.C., et al, Session on Appropriate Technology in Water Supply and Waste Disposal at the ASCE National Convention, Chicago, Illinois, Oct. 16-20, 1978. ASCE preprint 3435, New York, American Society of Civil Engineers, 1979, p.177-200, 23 refs.
Hais, A.B.
35-2751
WASTE TREATMENT, WATER TREATMENT, PONDS, COST ANALYSIS, STATISTICAL ANALYSIS, DESIGN.
Treatment ponds are a cost-effective alternative for municipal wastewater treatment. When compared to other secondary treatment alternatives, ponds are generally the least costly, require less energy and less skilled operational attention. They can be designed to consistently meet BOD removal requirements and can achieve significant reductions in nutrients, bacteria, and viruses.

MP 1414
LAND TREATMENT SYSTEMS AND THE ENVIRONMENT.
McKim, H.L., et al, Session on Appropriate Technology in Water Supply and Waste Disposal, at the ASCE National Convention, Chicago, Illinois, Oct. 16-20,-1978. ASCE preprint 3453, New York, American Society of Civil Engineers, 1979, p.201-225, 47 refs.
Bouzoun, J.R., Martel, C.J., Palazzo, A.J., Urban, N.W.
35-2752
WASTE DISPOSAL, WATER TREATMENT, LAND RECLAMATION, SEEPAGE, FLOODING, WASTE TREATMENT, ENVIRONMENTAL PROTECTION.

MP 1415
SELECTED DESIGN PARAMETERS OF EXISTING SYSTEMS FOR LAND APPLICATION OF LIQUID WASTE—A COMPUTER FILE.
Iskandar, I.K., Annual Conference of Applied Research and Practice on Municipal and Industrial Waste, 2nd, Madison, Wisconsin, Sep. 17-21, 1979. Proceedings, 1979, p.65-88, 5 refs.
35-2757
WASTE TREATMENT, WATER TREATMENT, LAND RECLAMATION, COMPUTER PROGRAMS, DESIGN.
Due to increasing interest in renovating wastewater by application on land, a computer file was established to store and retrieve information on design parameters, performance characteristics and published information on existing land application systems. The purpose of establishing this file was to provide assistance to design engineers during the planning of new land treatment systems. Currently there are about 350 domestic and 75 foreign systems on file. Two hypothetical examples are included for illustration.

MP 1416

POTHOLE PRIMER; A PUBLIC ADMINISTRATOR'S GUIDE TO UNDERSTANDING AND MANAGING THE POTHOLE PROBLEM.

Eaton, R.A., coord, Hanover, N.H., U.S. Army CRREL, ₍1981₎, 24p., 9 refs. Preliminary draft for presentation at the 11th Annual New England Asphalt Paving Conference, University of New Hampshire, *Durham*, N.H., 17 March 1981.
Bilello, M.A.
35-2758
ROAD MAINTENANCE, PAVEMENTS, DAMAGE, FROST ACTION, MUNICIPAL ENGINEERING, SAFETY, FATIGUE (MATERIALS), DRAINAGE, CRACKING (FRACTURING).

MP 1417

LAND TREATMENT: PRESENT STATUS, FUTURE PROSPECTS.

Pound, C.E., et al, *Civil engineering*, June 1978, 48(6), p.98-102, Also in: Articles on water and waste treatment, pollution control and related subjects. Reprinted from Civil engineering, Sep. 1977 through Sep. 1978, ₍1979₎, p.76-80.
Crites, R.W., Reed, S.C.
35-2760
LAND RECLAMATION, SEWAGE TREATMENT, WASTE TREATMENT, WATER TREATMENT, LEGISLATION, WATER POLLUTION, COST ANALYSIS.

MP 1418

EPA POLICY ON LAND TREATMENT AND THE CLEAN WATER ACT OF 1977.

Thomas, R.E., et al, *Journal of water pollution control*, Mar. 1980, 52(3), p.452-460, 10 refs.
Reed, S.C.
35-2759
WASTE TREATMENT, WATER TREATMENT, LAND RECLAMATION, LEGISLATION, WATER POLLUTION, DESIGN.

MP 1419

TRAVELING WAVE SOLUTION TO THE PROBLEM OF SIMULTANEOUS FLOW OF WATER AND AIR THROUGH HOMOGENEOUS POROUS MEDIA.

Nakano, Y., *Water resources research*, Feb. 1981, 17(1), p.57-64, 16 refs.
35-2796
POROUS MATERIALS, WATER FLOW, AIR FLOW, WAVE PROPAGATION, HYDRAULICS, BOUNDARY LAYER, WETTABILITY, ANALYSIS (MATHEMATICS).

A traveling wave solution was derived for the problem of simultaneous flow of water and air through homogeneous porous media. The properties of the solution generally depend upon the hydraulic characteristics of a given problem. The properties of the solution are presented for a specific case in which the hydraulic characteristics are given in specific functional forms. For this specific case a singularity occurs in the solution of both a saturated-unsaturated boundary and a wetting front. Some applications of the solution are discussed.

MP 1420

INTERNATIONAL AND NATIONAL DEVELOPMENTS IN LAND TREATMENT OF WASTEWATER.

McKim, H.L., et al, Technology Transfer Seminar on Effluent Irrigation under Prairie Conditions, Regina, Saskatchewan, Jan. 24-25, 1979. Papers, Canada, Environmental Protection Service, ₍1979₎, 28p., 58 refs.
Jenkins, T.F., Martel, C.J., Palazzo, A.J.
35-2794
WASTE TREATMENT, WATER TREATMENT, LAND RECLAMATION, PONDS, IRRIGATION, INTERNATIONAL COOPERATION.

MP 1421

TOXIC VOLATILE ORGANICS REMOVAL BY OVERLAND FLOW LAND TREATMENT.

Jenkins, T.F., et al, Water Pollution Control Federation. Annual Conference, 53rd, Las Vegas, Nev., Sep. 28-Oct. 3, 1980. Proceedings of the research symposia ₍Preprints₎, Washington, D.C., Water Pollution Control Federation, ₍1981₎, 14p., 27 refs.
Leggett, D.C., Martel, C.J., Peters, R.E., Lee, C.R.
35-2894
WASTE TREATMENT, WATER TREATMENT, SURFACE WATERS, FLOODING.

MP 1422

AQUACULTURE SYSTEMS FOR WASTEWATER TREATMENT: AN ENGINEERING ASSESSMENT.

Reed, S.C., et al, *U.S. Environmental Protection Agency. Office of Water Program Operations. Technical bulletin*, June 1980, 430/9-80-007, 127p., Refs. passim. For selected papers see 35-2860 and 35-2861.
Bastian, R.K.
35-2859
WASTE TREATMENT, WATER TREATMENT, SANITARY ENGINEERING, PONDS, COLD WEATHER PERFORMANCE.

MP 1423

ENGINEERING ASSESSMENT OF AQUACULTURE SYSTEMS FOR WASTEWATER TREATMENT: AN OVERVIEW.

Reed, S.C., et al, *U.S. Environmental Protection Agency. Office of Water Program Operations. Technical bulletin*, June 1980, 430/9-80-007, p.1-12.
Bastian, R.K., Jewell, W.
35-2860
WASTE TREATMENT, WATER TREATMENT, SANITARY ENGINEERING, PONDS.

MP 1424

MODELING A VARIABLE THICKNESS SEA ICE COVER.

Hibler, W.D., III, *Monthly weather review*, Dec. 1980, 108(12), p.1943-1973, 62 refs.
35-3514
SEA ICE, ICE COVER THICKNESS, SEASONAL VARIATIONS, *DRIFT*, *THERMODYNAMICS*, MODELS, LATENT HEAT, POLYNYAS, MASS BALANCE, ICE EDGE, ANALYSIS (MATHEMATICS).

MP 1425

SEASONAL GROWTH AND ACCUMULATION OF NITROGEN, PHOSPHORUS, AND POTASSIUM BY ORCHARDGRASS IRRIGATED WITH MUNICIPAL WASTE WATER.

Palazzo, A.J., *Journal of environmental quality*, Jan.-Mar. 1981, 10(1), p.64-68, 23 refs.
35-3515
WASTE TREATMENT, WATER TREATMENT, IRRIGATION, LAND RECLAMATION, VEGETATION, GROWTH, SEASONAL VARIATIONS, GRASSES, NUTRIENT CYCLE.

A 2-year field study was performed to determine the seasonal growth and nutrient accumulation of a forage grass receiving 7.5 cm/week of domestic primary-treated waste water. The average N and P concentrations in the waste water were 31.5 and 6.1 mg/liter, respectively. An established sward of 'Pennlate' orchardgrass (*Dactylis glomerata L.*) was managed on an annual three-cutting system. Grass samples were taken periodically during the growing season to determine plant dry matter accumulation and uptake of N, P, and K.

MP 1426

REVIEW OF SEA-ICE WEATHER RELATIONSHIPS IN THE SOUTHERN HEMISPHERE.

Ackley, S.F., *International Association of Hydrological Sciences. Publication*, 1981, No.131, Sea level, ice and climatic change: proceedings of the symposium held 7-8 Dec. 1979, edited by I. Allison, p.127-159, Refs. p.157-159.
35-3026
SEA ICE DISTRIBUTION, WEATHER, WIND (METEOROLOGY), OCEAN CURRENTS, ANTARCTICA.

Within the last decade data on sea ice from satellite coverage have become available for the Southern Hemisphere. The data record is reviewed with some consideration given to the different mechanisms of ice advection by wind forcing, thermodynamic growth, and ocean mixing. These mechanisms control the ice edge around Antarctica and lead to the characteristic advance-retreat relationships for the Weddell Sea, East Antarctica, and the Ross Sea. Recent statistical and function (EOF) analyses have shown two primary areas of higher annual variation of sea ice conditions which are presumed to be of dynamic (winds and currents) rather than thermodynamic (temperature) origin. It is postulated that atmospheric forcing of the sea ice system causes changes in air-sea energy transfers that then drive the atmosphere to its own anomaly condition. Further correlations that may define the mechanism of sea ice response to the forcing fields and supply stronger evidence of weather and climate responses to ice variations, may be available by analysis of the Global Weather Experiment drifting buoy data obtained during 1979. (Auth. mod.)

MP 1427

SEA-ICE ATMOSPHERE INTERACTIONS IN THE WEDDELL SEA USING DRIFTING BUOYS.

Ackley, S.F., *International Association of Hydrological Sciences. Publication*, 1981, No.131, Sea level, ice and climatic change: proceedings of the symposium held 7-8 Dec. 1979, edited by I. Allison, p.177-191, 23 refs.
35-3029
SEA ICE, ATMOSPHERIC CIRCULATION, PACK ICE, ATMOSPHERIC PRESSURE, DRIFT, AIR TEMPERATURE, WIND FACTORS, WEDDELL SEA.

Air-dropped data buoys were placed on the Weddell Sea pack ice during December 1978. These buoys transmit information via the NIMBUS satellite giving data on their position, surface pressure, and surface temperature. The velocities of four buoys during fall showed values up to 40 cm/s (35 km/day). The highest sustained velocities appear to coincide with sudden drops in air temperature. Schwerdtfeger (1979) has postulated a model of winds in the western Weddell Sea dominated by thermal rather than pressure gradient forces due to the damming of cold air from continental barrier and katabatic winds against the mountains of the Antarctic Peninsula. This model is examined to explain the drift rates associated with cold air outbreaks. (Auth.)

MP 1428

DELINEATION AND ENGINEERING CHARACTERISTICS OF PERMAFROST BENEATH THE BEAUFORT SEA.

Sellmann, P.V., et al, Environmental assessment of the Alaskan continental shelf, Vol.4. Hazards. Principal investigators' annual reports for the year ending March 1980, Rockville, Md., U.S. National Oceanic and Atmospheric Administration, 1981, p.125-157, 14 refs.
Chamberlain, E.J., Delaney, A.J., Neave, K.G.
35-3256
SUBSEA PERMAFROST, PERMAFROST DISTRIBUTION, BOTTOM SEDIMENT, DRILL CORE ANALYSIS, MAPPING, ENGINEERING, SEISMIC REFRACTION, WAVE PROPAGATION.

MP 1429

LAKE CHAMPLAIN ICE FORMATION AND ICE FREE DATES AND PREDICTIONS FROM METEOROLOGICAL INDICATORS.

Bates, R.E., Eastern Snow Conference, 37th. Proceedings, Peterborough, Ontario, Canada, 1980, p.125-143, 10 refs. For another version of this paper see 34-1745.
35-3153
LAKE ICE, ICE FORMATION, ICE GROWTH, FREEZEUP, ICE BREAKUP, WEATHER FORECASTING, ICE FORECASTING, WATER TEMPERATURE, WIND VELOCITY, LANDSAT, NAVIGATION.

A 19-year record of annual closing and opening dates of the Lake Champlain ferry season was found to accurately approximate the freeze-over and breakup dates for the ferry crossing area between Gordon Landing, Vermont, and Cumberland Head, N.Y. These lake navigation records, when compared statistically with the lake's wintertime thermal structure and climatological data for the same years of at nearby Lake Champlain locations, allowed accurate predictions of ice formation. From nearby air temperature records, cumulative freezing degree-day (C) curves were plotted for each year of record and ice formation dates and standard deviations were predicted with considerable accuracy. Several methods of predicting ice formation on Lake Champlain were attempted. The most accurate approach used a combination of water temperatures and freezing degree-days. A method of predicting ice growth rates is shown and the influence of wind speed on ice cover formation and prediction on a large body of water such as this is also discussed.

MP 1430

NEW 2 AND 3 INCH DIAMETER CRREL SNOW SAMPLERS.

Bates, R.E., et al, Eastern Snow Conference, 37th. Proceedings, Peterborough, Ontario, Canada, 1980, p.199-200, 1 ref. Extended abstract.
Rand, J.H., Redfield, R.
35-3163
SNOW SAMPLERS, ROOFS, SNOW LOADS, SNOW WATER EQUIVALENT, ICE LENSES.

MP 1431

SEA ICE STUDIES IN THE WEDDELL SEA ABOARD USCGC POLAR SEA.

Ackley, S.F., et al, *Antarctic journal of the United States*, 1980, 15(5), p.84-96, 7 refs.
Gow, A.J., Buck, K.R., Golden, K.M.
35-3188
SEA ICE, DRIFT, BIOMASS, WEDDELL SEA.

The purpose of this study was to investigate several characteristics of Weddell Sea pack ice that may affect the relative roles of dynamics and thermodynamics of pack ice development in this region. The physical and structural properties of the pack ice were surveyed using core samples. Significant amounts of frazil ice were found. If this formation of frazil ice is as widespread as suspected, then the role of deformation (the opening and closing of leads and polynyas) may have a greater role in the formation of Weddell Sea pack ice than similar processes do in the arctic pack. Four data buoys were deployed. The initial locations are shown, and the studies for which the buoy data will be used are discussed. Observations during the cruise confirmed the ubiquitous presence of algae in nearly all forms of ice sampled and point to close links between pack ice formation and enhanced algal production.

MP 1432
ABIOTIC COMPONENTS; INTRODUCTION.
Brown, J., Tundra ecosystems: a comparative analysis. Edited by L.C. Bliss, O.W. Heal and J.J. Moore. International biological programme, No.25. Cambridge University Press, 1981, p.79.
35-3377
ECOSYSTEMS, HYDROLOGY, CLIMATIC FACTORS, SOILS, SITE SURVEYS.

MP 1433
ANALYSIS OF PROCESSES OF PRIMARY PRODUCTION IN TUNDRA GROWTH FORMS.
Tieszen, L.L., et al, Tundra ecosystems: a comparative analysis. Edited by L.C. Bliss, O.W. Heal and J.J. Moore. International biological programme, No.25, Cambridge University Press, 1981, p.285-356, Refs. p.348-356.
35-3384
TUNDRA, BIOMASS, GROWTH, NUTRIENT CYCLE, WATER RESERVES, CLIMATIC FACTORS, SEASONAL VARIATIONS, SOIL TEMPERATURE, PHOTOSYNTHESIS.

MP 1434
POINT BARROW, ALASKA, USA.
Brown, J., Tundra ecosystems: a comparative analysis. Edited by L.C. Bliss, O.W. Heal and J.J. Moore. International biological programme, No.25, Cambridge University Press, 1981, p.775-776, 1 ref.
35-3400
TUNDRA, ECOSYSTEMS, VEGETATION, METEOROLOGICAL DATA, ANIMALS, ORGANIC SOILS, DECOMPOSITION, GEOMORPHOLOGY, UNITED STATES—ALASKA—BARROW.

MP 1435
HEAT TRANSFER IN COLD CLIMATES.
Lunardini, V.J., New York, Van Nostrand Reinhold Co., 1981, 731p., 35 refs.
35-3429
HEAT TRANSFER, MASS TRANSFER, PERMAFROST PHYSICS, TEMPERATURE EFFECTS, PHASE TRANSFORMATIONS, SOIL PHYSICS, STEFAN PROBLEM, GROUND ICE, SNOW PHYSICS, SOIL WATER, COLD WEATHER SURVIVAL, SOLAR RADIATION.

MP 1436
INVESTIGATION OF THE ACOUSTIC EMISSION AND DEFORMATION RESPONSE OF FINITE ICE PLATES.
Xirouchakis, P.C., et al, Offshore Technology Conference, 13th, Houston, Texas, May 4-7, 1981. Proceedings, Vol.3, 1981, p.123-133, 34 refs.
St. Lawrence, W.F.
35-3448
ICE CRACKS, ICE ELASTICITY, PLATES, ACOUSTIC MEASUREMENT, VISCOELASTICITY, CRACKING (FRACTURING), ICE CRYSTALS, FLEXURAL STRENGTH.

A procedure is described for monitoring the microfracturing of ice plates subjected to constant loads. Sample time records of fresh water ice plate deflections as well as corresponding total acoustic emission activities are presented. The linear elastic as well as viscoelastic response for a simply supported rectangular ice plate is given. In the present investigation acoustic emission methods are used to study the microfracturing activity in polycrystalline ice subjected to flexural loads. The relationship between acoustic emissions and the time dependent inelastic flexural deformation in ice is studied. Furthermore, the influence of the magnitude of the applied load and the rate of deformation on cracking activity is explored.

MP 1437
SOME APPROACHES TO MODELING PHASE CHANGE IN FREEZING SOILS.
Hromadka, T.V., II, et al, *Cold regions science and technology*, Apr. 1981, 4(2), p.137-145, 11 refs.
Guymon, G.L., Berg, R.L.
35-3670
SOIL FREEZING, PHASE TRANSFORMATIONS, THERMAL REGIME, UNFROZEN WATER CONTENT, SOIL WATER, MATHEMATICAL MODELS.

Phase change effects associated with freezing soils dominate the thermal state of the soil regime. Furthermore, freezing of soil water influences the soil moisture regime by providing a moisture sink which tends to draw mobile soil moisture to freezing fronts. Consequently, it is critical to general purpose models that soil water phase change effects and the interrelated problem of estimating the moisture sink effects (i.e., conversion of liquid water to ice) be accurately modeled. The choice of such a model will not only influence the precision of simulated temperatures and water contents in a freezing soil, but will also have a significant impact on computational efficiency. A review of several current models that assume unfrozen water content is functionally related to subfreezing temperatures indicates that within a freezing soil the soil water flow model and heat transport model parameters are restricted in spatial gradients according to the spatial gradient of modeled unfrozen water content. A freezing soil model based on the concept of isothermal phase change of soil water is proposed as an alternative approach.

MP 1438
CYLINDRICAL PHASE CHANGE APPROXIMATION WITH EFFECTIVE THERMAL DIFFUSIVITY.
Lunardini, V.J., *Cold regions science and technology*, Apr. 1981, 4(2), p.147-154, 13 refs.
35-3671
PHASE TRANSFORMATIONS, FREEZE THAW CYCLES, THERMAL DIFFUSION, PERMAFROST HEAT BALANCE, LATENT HEAT, PIPES (TUBES), ANALYSIS (MATHEMATICS).

No exact, general, solution exists for phase change in a cylindrical geometry. In fact, even approximate solutions are rare and limited in applicability. The use of the effective thermal diffusivity concept has allowed a closed form approximate solution to be generated for phase change around a circular cylinder in an indefinite medium. The effective diffusivity method permits solutions to be found for phase change problems merely by solving the usually linear, zero latent heat problem analogous to the phase change problem. Phase change problems are often intractable with the usual mathematical methods. The cylindrical formulae given here are shown to be of acceptable accuracy, for most engineering purposes, over a wide range of parameters. No other simple, closed form, approximation is known for the cylindrical system. Although the accuracy of the effective diffusivity method has been demonstrated for the cylindrical geometry, application to other geometries must be verified.

MP 1439
COASTAL-INLAND DISTRIBUTIONS OF SUMMER AIR TEMPERATURE AND PRECIPITATION IN NORTHERN ALASKA.
Haugen, R.K., et al, *Arctic and alpine research*, Nov. 1980, 12(4), p.403-412, 22 refs.
35-3196
TUNDRA, PRECIPITATION (METEOROLOGY), AIR TEMPERATURE, SHORES, LONG RANGE FORECASTING, WIND FACTORS, UNITED STATES—ALASKA—NORTH SLOPE.

Using data from summer air temperature stations from the inland tundra to the immediate coastal area, regression analyses of the air temperature data from 1975 to 1978 were used to predict temperature values across the Alaskan Arctic Coastal Plain based upon latitude and longitude. This provides the best approximation of average values based on existing data. Mean monthly temperature, mean daily range of temperature, and thawing-degree days all increase with distance from the coast. The estimated July normal for Atkasook, 48 km south of the coast, is 8.7 C, while the established 30-yr normal for Barrow, on the coast, is 3.7 C. The July average temperature 6 km due south of the open water of Prudhoe Bay is 2 C higher than on the immediate coast. Within the area under the dominant influence of the sea breeze, regression analyses suggest a more precise relationship between air temperature and distance along the prevailing wind vector (N75 E) than between temperature and distance due north to the sea.

MP 1440
MODELING NITROGEN TRANSPORT AND TRANSFORMATIONS IN SOILS: 1. THEORETICAL CONSIDERATIONS.
Selim, H.M., et al, *Soil science*, Apr. 1981, 131(4), p.233-241, 24 refs. For Pt. 2 see 34-4080.
Iskandar, I.K.
35-4081
SOIL CHEMISTRY, NUTRIENT CYCLE, TRANSFORMATIONS, SOIL WATER, WATER FLOW, WASTE TREATMENT, WATER TREATMENT, MATHEMATICAL MODELS.

A numerical model was developed to simulate water and nitrogen transport and transformations through water-unsaturated, multilayered soil profiles. The nitrogen transformation processes considered were nitrification, denitrification, immobilization, mineralization, and ionic exchange of ammonium. *Plant uptakes of water and nitrogen were also included.* An explicit-implicit finite difference approximation method was used to solve the nitrogen transport and transformation equations simultaneously with the water flow equation. Model evaluation and sensitivity analysis for a wide range of values for the rate of nitrification, distribution coefficient *for ammonium exchange, and rate of N uptake were investigated.* (Auth.)

MP 1441
MODELING NITROGEN TRANSPORT AND TRANSFORMATIONS IN SOILS: 2. VALIDATION.
Iskandar, I.K., et al, *Soil science*, May 1981, 131(5), p.303-312, 12 refs. For Pt. 1 see 35-4081.
Selim, H.M.
35-4080
SOIL CHEMISTRY, NUTRIENT CYCLE, TRANSFORMATIONS, WASTE TREATMENT, WATER TREATMENT, IONS, MODELS.

The nitrogen model described in Part 1 was evaluated using experimental data from a greenhouse lysimeter study for two soils, Windsor sandy loam and Charlton silt loam. Secondary treated waste water was applied to each soil at the rate of 3.8 centimeters twice weekly for 25 weeks. Furthermore, (15) N-enriched NH4 cation-N was applied, at the beginning of the experiment, in one waste water application. A mixture of grasses was grown on each lysimeter and was harvested every 2 to 4 weeks. Solution samples were collected and analyzed for N,and the soil water pressure head was monitored frequently at different soil depths. Model predictions agreed well with pressure head data with depth and time, as well as gravimetrically determined soil water content with depth for the two soils. (Auth. mod.)

MP 1442
ICE DISTRIBUTION AND WINTER SURFACE CIRCULATION PATTERNS, KACHEMAK BAY, ALASKA.
Gatto, L.W., International Geoscience and Remote Sensing Symposium (IGARSS'81), Washington, D.C., June 8-10, 1981. Digest, Vol.2, New York, Institute of Electrical and Electronics Engineers, 1981, p.995-1001, 6 refs.
35-3591
SEA ICE DISTRIBUTION, OCEAN CURRENTS, REMOTE SENSING, WIND FACTORS, LANDSAT, WINTER, SEASONAL VARIATIONS, UNITED STATES—ALASKA—KACHEMAK BAY.

MP 1443
INLET CURRENT MEASURED WITH SEASAT-1 SYNTHETIC APERTURE RADAR.
Shemdin, O.H., et al, *Shore and beach*, Oct. 1980, 48(4), p.35-37, 4 refs.
Jain, A., Hsiao, S.V., Gatto, L.W.
35-3704
WATER INTAKES, WATER FLOW, RADAR ECHOES, MICROWAVES, VELOCITY.

MP 1444
EFFECTIVENESS OF LAND APPLICATION FOR PHOSPHORUS REMOVAL FROM MUNICIPAL WASTE WATER AT MANTECA, CALIFORNIA.
Iskandar, I.K., et al, *Journal of environmental quality*, Oct.-Dec. 1980, 9(4), p.616-621, 18 refs.
Syers, J.K.
35-3705
SOIL CHEMISTRY, WASTE DISPOSAL, WATER TREATMENT, IRRIGATION, WASTE TREATMENT.

The concentrations of dissolved inorganic phosphate (DIP) in soil solution collected at 0.8 and 1.6 m in soils which had received municipal waste water for 4 and 13 years ranged from 7.3 to 13.9 microgram P/ml. In some cases, these concentrations were higher than that in the added waste water. Sorption studies indicated that the ability of soils from the control site to remove added P from solution was low. Waste water addition caused a substantial decrease in the P sorption capacity of surface soils and a marked change in isotherm shape from a curvilinear to an essentially linear isotherm. Sorption capacity generally increased down the profile to 60 cm on the treated sites. Only a small proportion of the total P accumulated from waste water addition was in the organic form. Large amounts of P were extractable by 0.01 M CaCl2, particularly in the upper 45 cm of the profiles receiving waste water. Although lack of crop removal of P and a high infiltration rate may be partly responsible for the poor performance of the Manteca system in terms of P removal from waste water, the very low P sorption capacity of the soil is regarded as the major factor.

MP 1445
MODELING HYDROLOGIC IMPACTS OF WINTER NAVIGATION.
Daly, S.F., et al, Specialty Conference Water Forum '81, San Francisco, Aug. 10-14, 1981. Proceedings. Vol.2, New York, American Society of Civil Engineers, 1981, p.1073-1080, 12 refs.
Weiser, J.R.
35-4166
ICE NAVIGATION, ICE LOADS, ICE BOOMS, ICE CONTROL, ICE JAMS, RIVER ICE, LAKE ICE, WATER LEVEL, WATER FLOW, MODELS.

This paper reports on a study undertaken to determine the hydrologic and hydraulic impacts of a proposed winter navigation demonstration program on the St. Lawrence River. The study assessed the impacts of modifying currently operational ice control booms on the levels and flows of Lake Ontario and the St. Lawrence River at several locations to control ice jamming and subsequent adverse effects on the Moses-Saunders Power Dam. The study assumed that an ice control boom would be modified to allow vessel transits for winter navigation. A one-dimensional hydraulic transient model that simulated water profiles and flows in the St. Lawrence River under both open water and ice covered conditions was utilized to determine the impacts of the increased ice cover thickness downstream caused by this modification. (Auth mod.)

MP 1446

SNOW REMOVAL EQUIPMENT.

Minsk, L.D., Handbook of snow: principles, processes, management and use. Edited by D.M. Gray and D.H. Male, Toronto, Pergamon Press, 1981, p.648-670, 11 refs.

35-3762

SNOW REMOVAL, EQUIPMENT, ROAD MAINTENANCE, WINTER MAINTENANCE.

MP 1447

APPLICATION OF REMOVAL AND CONTROL METHODS. SECTION 1: RAILWAYS; SECTION 2: HIGHWAYS; SECTION 3: AIRPORTS.

Minsk, L.D., et al, Handbook of snow: principles, processes, management and use. Edited by D.M. Gray and D.H. Male, Toronto, Pergamon Press, 1981, p.671-706, 24 refs.

Brohm, D.R., Cohen, S., Hawkins, L.M.E.

35-3763

SNOW REMOVAL, ICE CONTROL, WINTER MAINTENANCE, ROAD MAINTENANCE, RAILROADS, AIRPORTS, BRIDGES, EQUIPMENT, WHITEOUT, SNOW FENCES, SANDING.

MP 1448

ICE CONTROL AT NAVIGATION LOCKS.

Hanamoto, B., Specialty Conference Water Forum '81, San Francisco, Aug. 10-14, 1981. Proceedings. Vol.2. New York, American Society of Civil Engineers, 1981, p.1088-1095.

35-4168

ICE CONTROL, ICE NAVIGATION, LOCKS (WATERWAYS), BUBBLING, TESTS.

A method for controlling ice at navigation locks is presented. A high-flow air screen placed across the entrance of a lock holds back ice floating downstream or pushed head of traffic. The analysis is based on low-flow bubbler systems. The applicability of this analysis to high-flow systems is examined by conducting laboratory tests. (Auth.)

MP 1449

ICE CONTROL ARRANGEMENT FOR WINTER NAVIGATION.

Perham, R.E., Specialty Conference Water Forum '81, San Francisco, Aug. 10-14, 1981. Proceedings. Vol.2, New York, American Society of Civil Engineers, 1981, p.1096-1103, 9 refs.

35-4169

ICE NAVIGATION, ICE CONTROL, RIVER ICE, ICE JAMS, ICE BOOMS, WATER LEVEL.

This paper presents a four-year summary of the main effects of the booms on ice and ship interaction and vice-versa. Throughout the four winter seasons, relatively small quantities of ice were lost over and between the booms. Ships usually slid through without influencing the boom force levels, although, at times, the changes they wrought could be large. One boom needed strengthening and artificial islands were added for ice stability upstream. These devices and frequent icebreaker operations were able to compensate for the ice movement caused by winter navigation in this area.

MP 1450

KINETIC NATURE OF THE LONG TERM STRENGTH OF FROZEN SOILS.

Fish, A.M., International Symposium on Ground Freezing, 2nd, Trondheim, Norway, June 24-26, 1980. Preprints, Trondheim, University, Norwegian Institute of Technology, 1980, p.95-108, 23 refs.

36-8

FROZEN GROUND STRENGTH, SOIL CREEP, STRESSES, SOIL TEXTURE, TRIAXIAL TESTS, RHEOLOGY, TEMPERATURE EFFECTS, ANALYSIS (MATHEMATICS).

Temperature dependencies of the failure activation energy of frozen soils in the temperature range from -0.55 to -20C were studied. The analysis was based upon experimental data on the long-term failure of six frozen soils: Manchester and Ottawa sands, Suffield and Bat-Bayoss clays, Hanover silt and Kelovey sandy loam. The failure activation energy was expressed as a function of the rheological parameters of the long-term strength equation in the form of the sum of two components: an initial value that is independent of failure stress and a stress-dependent increment of the activation energy. The analysis showed that the initial value of the failure activation energy varied between the limits of 10.4 and 19.4 kcal/mole, the variation of stress-dependent increments was between 0.3 and 6.6 kcal/mole, and the sum varied from 12.9 to 19.7 kcal/mole. The smaller initial and sum values of the activation energy refer to the clay soils and the greater values to the sandy soils.

MP 1451

STRENGTH OF FROZEN SILT AS A FUNCTION OF ICE CONTENT AND DRY UNIT WEIGHT.

Sayles, F.H., et al, International Symposium on Ground Freezing, 2nd, Trondheim, Norway, June 24-26, 1980. Preprints, Trondheim, University, Norwegian Institute of Technology, 1980, p.109-119, 12 refs.

Carbee, D.L.

36-9

FROZEN GROUND STRENGTH, GROUND WATER, WATER CONTENT, STRESS STRAIN DIAGRAMS, COMPRESSIVE PROPERTIES, *GROUND ICE, LOADS (FORCES)*, GRAIN SIZE.

A total of 45 unconfined compression tests were conducted on frozen specimens of remolded, saturated Fairbanks silt at dry unit weights ranging from 993 to 1490 kilograms per cubic meter with total water contents ranging from 0.28 to 0.58. The rate of strain was 0.005/s. Using the criterion that the ice matrix in the soil fractures at the first point of significant yield shown in the stress-strain curve, which occurs at less than 0.01 strain in this study, the "ice matrix strength" is shown to be nearly proportional to the volumetric ice content of the soil for these tests. The strength at 0.2 strain appears to be nearly independent of the dry unit weight and water content of the soil.

MP 1452

OVERCONSOLIDATION EFFECTS OF GROUND FREEZING.

Chamberlain, E.J., International Symposium on Ground Freezing, 2nd, Trondheim, Norway, June 24-26, 1980. Preprints, Trondheim, University, Norwegian Institute of Technology, 1980, p.325-337, 10 refs.

36-27

SOIL FREEZING, CLAY SOILS, FREEZE THAW TESTS, FROZEN GROUND SETTLING, FROZEN GROUND STRENGTH, FROZEN GROUND MECHANICS, SOIL WATER MIGRATION, WATER CONTENT, STRESSES, DENSITY (MASS/VOLUME), SOIL STRUCTURE.

Settlement of clay soils after freezing and thawing is the result of the suction forces that draw pore water to the freezing front. These suction forces cause an increase in the effective stress on the clay beneath the freezing front, and thus cause an overconsolidation of the clay. As these suction forces often exceed 1 atmosphere, their direct measurement is not easy. The volume changes resulting from the freezing and thawing of clays are related to the plastic limit and have been observed in the laboratory to be as high as 25%. If provisions are not made to account for these volume changes in a ground freezing project, considerable damage to structures can occur from settlement and the resulting stresses.

MP 1453

STUDY OF THE CHOANOFLAGELLATES (ACANTHOECIDAE) FROM THE WEDDELL SEA, INCLUDING A DESCRIPTION OF *DIAPHANOECA MULTIANNULATA* N. SP.

Buck, K.R., *Journal of protozoology*, Feb. 1981, 28(1), p.47-54, 20 refs.

36-454

SEA ICE, MICROBIOLOGY, MARINE BIOLOGY, ANTARCTICA—WEDDELL SEA.

Eight species of loricate choanoflagellates (Acanthoecidae) have been observed, by light and electron microscopy, in samples obtained from the Weddell Sea during the austral summer of 1977. The distribution of most species within the Weddell Sea was widespread. Habitats included the water column, the edge of (or ponds on) ice floes, and the interior of ice floes. The distributional, environmental, habitat, and/or morphological range of all previously described species is expanded. Methods of variation of transverse costal diameters between genera may be potentially useful to the understanding of taxonomy and phylogeny of this family. (Auth. mod.)

MP 1454

NUMERICAL SOLUTIONS FOR RIGID-ICE MODEL OF SECONDARY FROST HEAVE.

O'Neill, K., et al, International Symposium on Ground Freezing, 2nd, Trondheim, Norway, June 24-26, 1980. Preprints, Trondheim, University, Norwegian Institute of Technology, 1980, p.656-669, 10 refs.

Miller, R.D.

36-54

FROST HEAVE, GROUND ICE, SOIL FREEZING, ICE FORMATION, ICE LENSES, ANALYSIS (MATHEMATICS), TEMPERATURE EFFECTS.

MP 1455

ON THE ACOUSTIC EMISSION AND DEFORMATION RESPONSE OF FINITE ICE PLATES.

Xirouchakis, P.C., et al, International Conference on Port and Ocean Engineering under Arctic Conditions, 6th, Québec, Canada, July 27-31, 1981. Proceedings, Québec, Canada, Université Laval, 1981, p.385-394, 15 refs.

St. Lawrence, W.F.

36-226

ICE ACOUSTICS, ICE CRACKS, FRACTURING, FLEXURAL STRENGTH, ICE LOADS, ICE CRYSTAL STRUCTURE, MICROSTRUCTURE, ICE DEFORMATION, STRESSES, STRAIN TESTS, ANALYSIS (MATHEMATICS).

In the present investigation acoustic emission methods are used to study the microfracturing activity in polycrystalline ice subjected to flexural loads. Experimental results obtained in the laboratory indicate that the acoustic emissions recorded from ice are important in describing the deformation and fracture of ice.

MP 1456

DYNAMIC ICE-STRUCTURE INTERACTION ANALYSIS FOR NARROW VERTICAL STRUCTURES.

Eranti, E., et al, International Conference on Port and Ocean Engineering under Arctic Conditions, 6th, Québec, Canada, July 27-31, 1981. Proceedings, Québec, Canada, Université Laval, 1981, p.472-479, 7 refs.

Haynes, F.D., Määttänen, M., Soong, T.T.

36-233

ICE SOLID INTERFACE, ICE MECHANICS, ICE LOADS, ICE PRESSURE, ICE STRUCTURE, DYNAMIC LOADS, PENETRATION TESTS, EXPERIMENTATION, FATIGUE (MATERIALS).

This paper describes a method of computing the ice force and response of the structure on the basis of information given for ice velocity and properties of ice and the structure. The method is a step-by-step procedure using mode shape analysis involving two basic phases. During the first phase the structure penetrates into the ice sheet until a random loading rate dependent ice strength is reached. The ice sheet then fails within an area with finite length. Both the penetration and the failed zone are assumed to depend linearly on force. The ice forces and structural responses have been computed for a test structure at the U.S. Army Cold Regions Research and Engineering Laboratory in Hanover, New Hampshire, and the results are found to be consistent with those actually measured in laboratory experiments.

MP 1457

SUMMER CONDITIONS IN THE PRUDHOE BAY AREA, 1953-75.

Cox, G.F.N., et al, International Conference on Port and Ocean Engineering under Arctic Conditions, 6th, Québec, Canada, July 27-31, 1981. Proceedings, Québec, Canada, Université Laval, 1981, p.799-808, 9 refs.

Dihn, W.S.

36-262

SEA ICE DISTRIBUTION, ICE CONDITIONS, RADIOMETRY, SEASONAL VARIATIONS, PETROLEUM INDUSTRY, ICE BREAKUP, FREEZEUP.

Long-term, site-specific statistics on the summer ice conditions in the Harrison Bay-Camden Bay area are presented in probabilistic terms. The statistics are based on twenty-three years of ice observations acquired by commercial ships and icebreakers, ice reconnaissance flights, and various satellites. Data is given on breakup and freezeup dates, the first occurrence of open water, and the number of continuous and total open water days. The impact of the summer ice conditions on petroleum activities in the study area are also briefly discussed.

MP 1458

PRELIMINARY RESULTS OF ICE MODELING IN THE EAST GREENLAND AREA.

Tucker, W.B., et al, International Conference on Port and Ocean Engineering under Arctic Conditions, 6th, Québec, Canada, July 27-31, 1981. Proceedings, Québec, Canada, Université Laval, 1981, p.867-878, 13 refs.

Hibler, W.D., III.

36-267

ICE MODELS, ICE PLASTICITY, STRESSES, DRIFT, THERMODYNAMICS, SEA ICE, BUOYANCY, VISCOSITY.

A sea ice model which employs a viscous-plastic constitutive law has been applied to the East Greenland area. The model is run on a 40-km spatial scale at 1/4 day time steps for a 60-day period, using forcing data beginning 1 October 1979. Preliminary results verify that the model predicts reasonable thicknesses and velocities well within the ice margin. Separate simulations show that thermodynamics only and free drift with thermodynamics produce inadequate results. In particular, the free drift simulation produces unrealistic ice trajectories with excessive drift toward the coast and unreasonable nearshore thicknesses. The net results of these simulations tend to verify that internal ice stress, thermodynamics, and ice import must be considered to properly model this region.

MP 1459

POOLING OF OIL UNDER SEA ICE.

Kovacs, A., et al, International Conference on Port and Ocean Engineering under Arctic Conditions, 6th, Québec, Canada, July 27-31, 1981. Proceedings, Québec, Canada, Université Laval, 1981, p.912-922, 15 refs.

Morey, R.M., Cundy, D.F., Dicoff, G.

36-271

OIL SPILLS, SEA ICE, ICE BOTTOM SURFACE, ICE COVER THICKNESS, PROFILES, RADAR ECHOES, ECHO SOUNDING, WATER POLLUTION, ENVIRONMENTAL IMPACT.

Ice thickness profiles were constructed for six fast ice locations in the vicinity of Prudhoe Bay, Alaska, using a radar echo sounding system. The sounding data revealed in detail the undulating relief of the bottom of the sea ice in which oil could pool up if released under the ice. In general, ice bottom morphology was found to reflect variation of the surface snow cover thickness and ice deformation. However, at several sites the ice bottom relief could not be correlated with these factors. Slush ice accumulations of up to 0.5 m were apparently the cause of this bottom roughness. Estimates of the volume of oil that could pool up in the ice bottom relief range from 20,000 to 60,000 cu m/sq km. For undeformed fast ice with no bottom slush ice growth, the potential pooling capacity varied from about 10,000 to 35,000 cu m/sq km. The effect of slush ice relief and structure on potential under-ice oil pooling is for the most part unknown.

MP 1460

SEA ICE PILING AT FAIRWAY ROCK, BERING STRAIT, ALASKA: OBSERVATIONS AND THEORETICAL ANALYSIS.

Kovacs, A., et al, International Conference on Port and Ocean Engineering under Arctic Conditions, 6th, Québec, Canada, July 27-31, 1981. Proceedings, Québec, Canada, Université Laval, 1981, p.985-1000, 15 refs.

Sodhi, D.S.

36-276

SEA ICE, ICE PILEUP, ICE CONDITIONS, ICE FORMATION, PRESSURE RIDGES, REMOTE SENSING, LANDSAT, GROUNDED ICE, FLEXURAL STRENGTH, FLOATING ICE, ANALYSIS (MATHEMATICS), OFFSHORE STRUCTURES.

Information on sea ice conditions in the Bering Strait and the icefoot formation around Fairway Rock, located in the strait, is presented. Cross-sectional profiles of Fairway Rock and the relief of the icefoot are given along with theoretical analyses of the possible forces active during icefoot formation. It is shown that the ice cover most likely fails in flexure as opposed to crushing or buckling, as the former requires less force. Field observations reveal that the Fairway Rock icefoot is massive, with ridges up to 15 m high, a seaward face only 20 deg from vertical, and interior ridge slopes averaging 33 deg. The icefoot is believed to be grounded, and its width ranges from less than 10 to over 100 meters.

MP 1461

PLANETARY AND EXTRAPLANETARY EVENT RECORDS IN POLAR ICE CAPS.

Zeller, E.J., et al, Colloquium on Planetary Water, 3rd, Niagara Falls, New York, Oct. 27-29, 1980. Proceedings, Buffalo, N.Y., State University of New York, ₍1980₎, p.18-27, 6 refs.

Parker, B.C., *Gow, A.J.*

36-565

ICE SHEETS, LAND ICE, GLACIER MASS BALANCE, PLANETARY ENVIRONMENTS, ATMOSPHERIC COMPOSITION, VOLCANIC ASH.

A curve of nitrate-N concentration, plotted from 1653 individual analyses from a 108 meter firn core drilled at South Pole Station in 1978-79, is presented. The most prominent feature of the background curve is the sharp drop in nitrate between 1650 and 1720, a period of unusually low solar activity. It is suggested that a comparison of this data with those of polar caps of other planets would make it possible to identify solar system-wide effects.

MP 1462

DISTINGUISHING CHARACTERISTICS OF DIAMICTONS AT THE MARGIN OF THE MATANUSKA GLACIER, ALASKA.

Lawson, D.E., ***Annals of glaciology***, 1981, Vol.2, p.78-84, 34 refs.

36-636

GLACIAL DEPOSITS, SUBGLACIAL DRAINAGE, MORAINES, SEDIMENT TRANSPORT.

The origins of diamictons deposited at the Matanuska Glacier are identified in stratigraphic sequences mainly by the presence or absence of a pebble fabric, internal structure, and variation in gravel-size clast distribution. These properties correlate with major differences in depositional mechanisms and source material. Melt-out till mostly inherits fabric, internal structure, and grain-size distribution from its debris-laden basal ice source. Sediment flow deposits and ice-slope colluvium (deposited by ablational slope processes) have properties developed by resedimentation mechanisms. Melt-out till ranges from structureless to stratified with interspersed lenses and discontinuous laminae, and generally possesses a well-defined pebble fabric.

MP 1463

ECOLOGICAL IMPACT OF WHEELED, TRACKED, AND AIR CUSHION VEHICLE TRAFFIC ON TUNDRA.

Abele, G., International Society for Terrain-Vehicle Systems. International Conference, 7th, Calgary, Alberta, Aug. 16-20, 1981. Proceedings, Hanover, N.H., ISTVS, 1981, p.11-37, 19 refs.

36-760

TUNDRA, DAMAGE, ALL TERRAIN VEHICLES, TRACKED VEHICLES, ENVIRONMENTAL IMPACT, VEHICLE WHEELS, PLANT ECOLOGY.

Traffic tests were conducted on Alaskan tundra near Barrow in 1971. The impact of an air cushion vehicle is significantly less than that of a tracked or wheeled vehicle and is limited to whatever damage is done to the vegetation by skirt contact; the effects of cushion pressure and cushion air flow are insignificant. The impact of wheeled and tracked vehicles is influenced primarily by the type and geometry of tires or tracks, ground contact pressure, and the number of traffic passes.

MP 1464

SUBSEA TRENCHING IN THE ARCTIC.

Mellor, M., International Society for Terrain-Vehicle Systems. International Conference, 7th, Calgary, Alberta, Aug. 16-20, 1981. Proceedings, Hanover, N.H., ISTVS, 1981, p.843-882, Refs. p.873-875.

36-768

TRENCHING, OCEAN BOTTOM, BOTTOM SEDIMENT, PIPELINES, ICE SCORING, PRESSURE RIDGES, ICEBERGS.

Environmental conditions are described for the continental shelf of the western Arctic, and for the shelf of Labrador and Newfoundland. Special emphasis is given to the gouging of bottom sediments by ice pressure ridges and icebergs, and an approach to systematic risk analysis is outlined. Protection of subsea pipelines and cables by trenching and direct embedment is discussed, touching on burial depth, degree of protection, and environmental impact. Conventional land techniques can be adapted for trenching across the beach and through the shallows, but in deeper water special equipment is required.

MP 1465

MORPHOLOGICAL INVESTIGATIONS OF FIRST-YEAR SEA ICE PRESSURE RIDGE SAILS.

Tucker, W.B., et al, *Cold regions science and technology*, 1981, Vol.5, p.1-12, 16 refs.

Govoni, J.W.

36-811

PRESSURE RIDGES, SEA ICE, ICE STRUCTURE, ICE COVER THICKNESS, OFFSHORE STRUCTURES, ICE PRESSURE, ICE STRENGTH.

MP 1466

COLD WEATHER CONSTRUCTION MATERIALS; PART 2—REGULATED-SET CEMENT FOR COLD WEATHER CONCRETING, FIELD VALIDATION OF LABORATORY TESTS.

Houston, B.J., et al, *U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi. Miscellaneous paper*, Sep. 1981, C-75-11, 33p.

Hoff, G.C.

36-1028

CONSTRUCTION MATERIALS, WINTER CONCRETING, CONCRETE STRENGTH, CEMENTS, CONCRETE PLACING, CONCRETE AGGREGATES, TEMPERATURE EFFECTS, TESTS.

MP 1467

SURFACE DISTURBANCE AND PROTECTION DURING ECONOMIC DEVELOPMENT OF THE NORTH.

Brown, J., et al, Novosibirsk, Nauka, 1981, 88p., In Russian with English table of contents enclosed. Refs. p.59-80.

Grave, N.A.

36-1009

PERMAFROST PRESERVATION, HUMAN FACTORS, DAMAGE, OIL SPILLS, PERMAFROST DISTRIBUTION.

MP 1468

SEA ICE: THE POTENTIAL OF REMOTE SENSING.

Weeks, W.F., *Oceanus, Fall* 1981, 24(3), p.39-48.

36-1047

SEA ICE, LAKE ICE, ICE PHYSICS, REMOTE SENSING, SPACEBORNE PHOTOGRAPHY.

MP 1469

MODELING OF ANISOTROPIC ELECTROMAGNETIC REFLECTIONS FROM SEA ICE.

Golden, K.M., et al, *Journal of geophysical research*, Sep. 20, 1981, 86(C9), p.8107-8116, 17 refs.

Ackley, S.F.

36-1089

SEA ICE, ICE SALINITY, ELECTROMAGNETIC PROPERTIES, ANISOTROPY.

The contribution of brine layers to observed reflective anisotropy of sea ice at 2100 MHz is quantitatively assessed, and a theoretical explanation for observed reflective anisotropy is proposed in terms of anisotropic electric flux penetration into the brine layers. The sea ice is assumed to be a stratified dielectric consisting of prue ice containing ellipsoidal conducting inclusions (brine layers) uniformly aligned with their long axes perpendicular to the preferred crystallographic *c* axis direction. The asymmetrical geometry of the brine layers is shown to produce an anisotropy in the complex dielectric constant of sea ice. The contribution of these layers to the reflective anisotropy is examined with a numerical method of approximating the reflected power of a radar pulse incident on a slab of sea ice. (Auth. mod.)

MP 1470

INTEGRAL TRANSFORM METHOD FOR THE LINEARIZED BOUSSINESQ GROUNDWATER FLOW EQUATION.

Daly, C.J., et al, *Water resources research*, Aug. 1981, 17(4), p.875-884, 10 refs.

Morel-Seytoux, H.J.

36-1123

GROUND WATER, WATER FLOW, MATHEMATICAL MODELS, SOIL WATER.

An analytical procedure is developed for the determination of potentiometric head in nonhomogeneous aquifers. Both steady and unsteady flow conditions are considered. The analytical procedure is based upon the use of orthogonal functions. It consists essentially of assuming an appropriate orthogonal series for both the aquifer properties and the unknown potentiometric head. The technique is applied to several one- and two-dimensional flow problems where conditions are described by the linearized Boussinesq equation. The result of the analysis is the expression of potentiometric heads in analytic form. Subsequent use of Darcy's law yields accurate, analytic equations for the associated velocity fields. Such representations of the flow field are a potential benefit for prediction of mass transport in groundwater since velocity is known as a continuous function of space and time. Other useful features of the orthogonal series approach include its straightforward application. The approach is also shown to eliminate the introduction of discretization errors associated with the use of node systems which are required by many alternative numerical methods.

MP 1471

***WATERSHED MODELING IN COLD REGIONS:* AN APPLICATION TO THE SLEEPERS RIVER RESEARCH WATERSHED IN NORTHEASTERN VERMONT.**

Stokely, J.L., Hanover, N.H., Dartmouth College, June 1980, 241p., M.E. thesis. Refs. p.175-192.

36-1275

WATERSHEDS, SNOWMELT, RUNOFF, FROZEN GROUND, SOIL WATER, STREAM FLOW, SNOW ACCUMULATION, ABLATION, MODELS, COMPUTER APPLICATION, HYDROLOGY, FLOODS.

MP 1472

DISTORTION OF MODEL SUBSURFACE RADAR PULSES IN COMPLEX DIELECTRICS.

Arcone, S.A., ***Radio science***, Sep.-Oct. 1981, 16(5), p.855-864, 19 refs.

36-1864

SEA ICE, GROUND ICE, ICE ELECTRICAL PROPERTIES, RADAR ECHOES, SUBSURFACE INVESTIGATIONS, WAVE PROPAGATION, ELECTRIC FIELDS, MATHEMATICAL MODELS, DIELECTRIC PROPERTIES.

The propagation of subsurface radar pulses in complex dielectric media is studied numerically. The model waveform is a 10-ns sinusoidal cycle, and the media properties are similar to those of moist ground or sea ice. When the real part of the dielectric permittivity is frequency independent and the imaginary part is dominated by the dc resistivity, amplitudes of the positive and negative half cycles unbalance, and the sinusoidal zero crossing is delayed from its normal position. In these cases, if reflector depth is known, the dielectric constant can be measured from the time delay of the leading edge of the signal, and the dc resistivity can be estimated from a comparison of the input and output pulse power spectra. When dielectric permittivity is frequency dependent through a simple relaxation process, waveform distortion depends on relaxation frequency. In addition, if reflector depth is known, the dielectric relaxation parameters may be estimated when the medium relaxation frequency lies above and below the major portion of the pulse bandwidth, respectively.

MP 1473

SNOW MEASUREMENTS IN RELATION TO VEHICLE PERFORMANCE.

Harrison, W.L., *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* July, 1981, No.81-16, p.13-24, ADA-106 972, 2 refs.

36-1392

SNOW COMPRESSION, VEHICLES, TRACTION, SNOW DEPTH, SNOW DRIFT, SNOW CRYSTAL STRUCTURE, SNOW DENSITY, SNOW COVER EFFECT.

MP 1474

APPLICATION OF ENERGETICS TO VEHICLE TRAFFICABILITY PROBLEMS.

Brown, R.L., *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* July, 1981, No.81-16, p.25-38, ADA-106 972, 8 refs.

36-1393

SNOW COVER EFFECT, TRACTION, VEHICLES, TRAFFICABILITY, SNOW DENSITY, SNOW COMPACTION.

MP 1475

PREDICTION METHODS.

Harrison, W.L., *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* July, 1981, No.81-16, p.39-46, ADA-106 972.

36-1394

SNOW COVER EFFECT, TRACTION, VEHICLES, TRAFFICABILITY, SNOW STRENGTH, FORECASTING, MATHEMATICAL MODELS, SNOW DEPTH, VEHICLE WHEELS, TRACKED VEHICLES.

MP 1476

FIELD INVESTIGATIONS.

Harrison, W.L., *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* July, 1981, No.81-16, p.47-48, ADA-106 972.

36-1395

SNOW COVER EFFECT, TRACTION, VEHICLES, TRAFFICABILITY, TESTS.

MP 1477

ANALYSIS OF VEHICLE TESTS AND PERFORMANCE PREDICTIONS.

Berger, R.H., et al, *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* July, 1981, No.81-16, p.51-67, ADA-106 972.

Brown, R.L., Harrison, W.L., Irwin, G.S.

36-1396

SNOW STRENGTH, VEHICLES, TRACTION, SHEAR STRESS, LOADS (FORCES), SNOW COMPACTION, TESTS, SNOW DEPTH, FORECASTING, ANALYSIS (MATHEMATICS).

MP 1478

SHALLOW SNOW TEST RESULTS.

Harrison, W.L., *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* July, 1981, No.81-16, p.69-71, ADA-106 972.

36-1397

SNOW DEPTH, SNOW COVER EFFECT, VEHICLES, TRACTION, TRAFFICABILITY, SHEAR STRESS, TESTS.

MP 1479

OBSERVATIONS OF CONDENSATE PROFILES OVER ARCTIC LEADS WITH A HOT-FILM ANEMOMETER.

Andreas, E.L., et al, *Royal Meteorological Society, London. Quarterly journal,* 1981, Vol.107, p.437-460, Refs. p.457-460.

Williams, R.M., Paulson, C.A.

36-1199

POLYNYAS, PACK ICE, PROFILES, DROPS (LIQUIDS), TURBULENT EXCHANGE, WATER TEMPERATURE, TEMPERATURE GRADIENTS, CONDENSATION, ANEMOMETERS, ANALYSIS (MATHEMATICS).

MP 1480

THERMAL ENERGY AND THE ENVIRONMENT.

Crosby, R.L., et al, Hanover, N.H., U.S. Army Cold Regions Research and Engineering Laboratory, Nov. 1975, 3p. + 2p. figs., Presented at Energy and Environment Conference, Dallas, Texas.

Aamot, H.W.C., Wright, E.A.

36-1422

HEAT SOURCES, HEAT LOSS, THERMAL EFFECTS, THERMAL POLLUTION, ENVIRONMENTAL IMPACT, COLD WEATHER CONSTRUCTION, POLAR REGIONS.

MP 1481

INLET CURRENT MEASURED WITH SEASAT-1 SYNTHETIC APERTURE RADAR.

Shemdin, O.H., et al, *Shore and beach,* Oct. 1980, 48(4), p.35-37, 4 refs.

Jain, A., Hsiao, S.V., Gatto, L.W.

36-1430

WATER INTAKES, OCEAN CURRENTS, REMOTE SENSING, AIRBORNE RADAR, MICROWAVES.

MP 1482

COMPARISON OF THERMAL OBSERVATIONS OF MOUNT ST. HELENS BEFORE AND DURING THE FIRST WEEK OF THE INITIAL 1980 ERUPTION.

St. Lawrence, W.F., et al, *Science,* Sep. 26, 1980, Vol.209, p.1526-1527, 11 refs.

Qamar, A., Moore, J., Kendrick, G.

36-1549

THERMAL REGIME, VOLCANOES, TEMPERATURE MEASUREMENT, INFRARED RECONNAISSANCE, MOUNTAINS, VOLCANIC ASH, UNITED STATES—WASHINGTON—MOUNT SAINT HELENS.

MP 1483

RESULTS FROM A MATHEMATICAL MODEL OF FROST HEAVE.

Guymon, G.L., et al, *Transportation research record,* 1981, No.809, p.2-6, 13 refs.

Berg, R.L., Johnson, T.C., Hromadka, T.V., II.

36-1729

FROST HEAVE, HEAT TRANSFER, SOIL WATER MIGRATION, FROST PENETRATION, TEMPERATURE EFFECTS, MATHEMATICAL MODELS.

A one-dimensional model for simulation of frost heave in a vertical soil column is presented. The model is based on simultaneous computation of heat and moisture transport in a freezing or thawing soil. Thermal processes at the freezing front are approximated by a lumped isothermal approach. The model accurately simulates frost heave, soil pore-water pressures, and temperatures when compared with a laboratory freezing column; however, to achieve adequate correlation certain model parameters must be determined by calibration. Because the model, like the frost-heave process itself, is highly sensitive to environmental and soil parameters that are variable in both time and space, purely deterministic simulations will not provide sufficiently accurate predictions. Consequently, further development of the model is required in order to include a statistical-probabilistic approach for estimating frost heave within specified confidence limits.

MP 1484

EFFECT OF FREEZING AND THAWING ON RESILIENT MODULUS OF A GRANULAR SOIL EXHIBITING NONLINEAR BEHAVIOR.

Cole, D.M., et al, *Transportation research record,* 1981, No.809, p.19-26, 15 refs.

Irwin, L.H., Johnson, T.C.

36-1732

FREEZE THAW CYCLES, SUBGRADE SOILS, SOIL STRENGTH, SOIL FREEZING, GROUND THAWING, ELASTIC PROPERTIES, STRESSES, DENSITY (MASS/VOLUME), SOIL TEMPERATURE.

Freeze-thaw cycles experienced in areas of seasonal frost can cause wide variations in the supporting capacity of subgrade materials. The U.S. Army Cold Regions Research and Engineering Laboratory is currently engaged in a program to assess these variations in a number of soils used in roadway and airfield construction. The complete testing and analysis procedure for one of these test soils is presented.

MP 1485

SIMULATING FROST ACTION BY USING AN INSTRUMENTED SOIL COLUMN.

Ingersoll, J., et al, *Transportation research record,* 1981, No.809, p.34-42, 6 refs.

Berg, R.L.

36-1734

FROST ACTION, FROZEN GROUND MECHANICS, FREEZE THAW TESTS, SOIL WATER, SOIL TEMPERATURE, WATER CONTENT, MATHEMATICAL MODELS.

The use of an instrumented soil column in tests to develop a mathematical model of the frost-heave process is described. Tensiometers, heat-flow meters, thermocouples, and electrical resistivity gages were installed throughout a soil column filled with Fairbanks silt, Chena Hot Springs silt, or West Lebanon gravel. The column was 100 cm long and about 14 cm in diameter. An open system was used and absorption was monitored during the freezing process. Tests were conducted by using a constant rate of frost penetration, a constant heat-flow rate, or three sequentially lower temperature step changes at the soil surface. The soil column has provided critical data for verification of a one-dimensional mathematical model for estimating frost heave. As more soils are tested, this equipment will assist in improving and developing algorithms for the mathematical model and the most critical parameters that affect frost heave in a given soil-e.g., surcharge, free water level, and hydraulic conductivity. A procedure is also presented for determining the saturated and unsaturated hydraulic conductivity and moisture-retention characteristics of a soil.

MP 1486

COMPARATIVE EVALUATION OF FROST-SUSCEPTIBILITY TESTS.

Chamberlain, E.J., *Transportation research record,* 1981, No.809, p.42-52, 89 refs.

36-1735

SOIL FREEZING, SOIL WATER, FROST RESISTANCE, FROST HEAVE, GROUND ICE, FREEZE THAW TESTS, FROST ACTION, GRAIN SIZE, PARTICLE SIZE DISTRIBUTION.

Methods of determining the frost susceptibility of soils are identified and presented. More than 100 criteria were found; the most common were based on particle-size characteristics. These particle size criteria are frequently augmented by information such as grain-size distribution, uniformity coefficients, and Atterberg limits. Other types of information, such as permeability, mineralogy, and soil classification, have also been required. More complex methods that require tests based on pore-size distribution, moisture tension, hydraulic conductivity, heave stress, and frost heave have also been proposed. However, none has proved to be a universal test for determining the frost susceptibility of soils. Based on this survey, four methods are proposed for further study: the U.S. Army Corps of Engineers Frost-Susceptibility Classification Systems, the moisture-tension/hydraulic-conductivity test, a new frost-heave test, and the California bearing ratio after-thaw test.

MP 1487

SIMULATION OF THE ENRICHMENT OF ATMOSPHERIC POLLUTANTS IN SNOW COVER RUNOFF.

Colbeck, S.C., *Water resources research,* Oct. 1981, 17(5), p.1383-1388, 17 refs.

36-1887

AIR POLLUTION, SNOW IMPURITIES, RUNOFF, MELTWATER, WATER POLLUTION, SNOW MELTING, FREEZE THAW CYCLES, SOLUBILITY, SNOW DEPTH.

The soluble impurities contained in a snow cover can be concentrated as much as five fold in the first fractions of snowmelt runoff. In addition, daily impurity surges are possible. Melt-freeze cycles concentrate the impurities in the lower portion of the snow cover, hence preparing the impurities for rapid removal. Environmental damage can occur due to the concentration and rapid release of atmospheric pollutants from the snow, especially in areas of 'acid precipitation.' The enrichment of the soluble impurities is explained and the results of laboratory experiments are given.

MP 1488

TESTS OF FRAZIL COLLECTOR LINES TO ASSIST ICE COVER FORMATION.

Perham, R.E., *Canadian journal of civil engineering,* Dec. 1981, 8(4), p.442-448, With French summary. 1 ref.

36-1866

FRAZIL ICE, ICE FORMATION, ICE ACCRETION, ICE GROWTH, WATER FLOW, ICE COVER STRENGTH, RIVER ICE, NUCLATING AGENTS, ICE BOOMS.

A preliminary investigation was made of the effect of frazil ice on arrays of lines positioned in flowing water under winter conditions. It was found that the lines would provide a stable basis for forming an ice cover on many stream reaches that would normally remain open because of high velocity and shallow depths. Tests were conducted in a refrigerated flume and in small mountain rivers. Flume depths varied from 2-22 cm and river depths varied from 33-50 cm. Average flow velocities had a range of 0.08-0.04 m/s in the flume and a range of 0.6-0.8 m/s in the rivers. Frazil ice would grow on a line quite rapidly achieving a diameter of 32 mm in 15 min, on a 3.2 mm dia. line in the flume. In the river, overnight accumulations reached 20 cm in depth. A few drag force measurements were made which yielded an average shear drag coefficient of 0.16. The results suggest methods of increasing our control over ice.

MP 1489

ONE-DIMENSIONAL TRANSPORT FROM A HIGHLY CONCENTRATED, TRANSFER TYPE SOURCE.

O'Neill, K., *International journal of heat and mass transfer,* 1982, 25(1), p.27-36, With French, German and Russian summaries. 27 refs.

36-1863

HEAT TRANSFER, MASS TRANSFER, FLOW RATE, ANALYSIS (MATHEMATICS).

In both heat and mass transfer, situations arise in which an entity considered as a source/sink has strength which can only be expressed in terms of an unknown rate of source—flow field transfer. This occurs when transfer between the source and medium is driven by a dependent variable difference which is unknown, because the responding medium value is unknown. Manifold mathematical complexities arise when in addition the source is highly concentrated spatially relative to the size of the overall domain. A 1-dim convective-diffusive transport equation suitable for this cause may be solved by simultaneous use of the Fourier transform and its inverse in the same equation, together with other transformation and manipulation. From the solution obtained for the case of constant source intensity, one may construct a general expression for the solution when source intensity varies arbitrarily in time. Explicit expressions are obtained for solution of the fundamental case of temporally sinusoidal source intensity.

MP 1490

SMALL CALIBER PROJECTILE PENETRATION IN FROZEN SOIL.

Richmond, P.W., *Journal of ballistics*, July 1980, 4(3), p.801-823, 11 refs.
36-1820
PROJECTILE PENETRATION, FROZEN GROUND STRENGTH, IMPACT STRENGTH.

MP 1491

REMOTE SENSING OF WATER QUALITY USING AN AIRBORNE SPECTRORADIOMETER.

McKim, H.L., et al, International Symposium on Remote Sensing of the Environment, 14th, San Jose, Costa Rica, Apr. 23-30, 1980. Proceedings, [1980], p.1353-1362, 6 refs.
Merry, C.J., Layman, R.W.
36-1886
WATER CHEMISTRY, REMOTE SENSING, SUSPENDED SEDIMENTS, SPECTROSCOPY, RADIOMETRY, AIRBORNE EQUIPMENT.

An airborne spectroradiometer with 500 parallel channels has been used to monitor water quality in various water environments. Field experiments were run to test and evaluate the instrument's response to various amounts of suspended materials in water. Procedures were evaluated in the laboratory to separate the various components from the total reflected radiance and to correlate the spectral distribution of the subsurface reflectance to the organic/inorganic materials in the water. It was concluded that qualitative and quantitative measurement of turbidity within a water body is possible using the airborne spectroradiometer. The accuracy of the quantitative measurement is still under investigation, but suspended sediment concentration of less than 5 ppm can be detected. Organic and inorganic constituents can be qualitatively differentiated.

MP 1492

FULL-DEPTH AND GRANULAR BASE COURSE DESIGN FOR FROST AREAS.

Eaton, R.A., et al, *American Society of Civil Engineers. Transportation engineering journal*, Jan. 1982, 108(TE1), p.27-39, 13 refs.
Payne, J.O., Jr.
36-2081
FROST PENETRATION, SUBGRADE SOILS, PAVEMENTS, BEARING STRENGTH, FREEZE THAW CYCLES, FROST HEAVE, SOIL STRENGTH, SOIL WATER, FREEZING INDEXES, DESIGN CRITERIA, DYNAMIC LOADS, DEFORMATION.

When properly designed and constructed, the Asphalt Institute full-depth pavement concept can be a viable design alternative for seasonal frost areas. The Corps of Engineers reduced subgrade strength frost design proved to be an upper bound or conservative design under these test conditions. For each design, two different thicknesses were studied in test sections placed over 12 in. of prepared subgrade and tested under light traffic conditions in Hanover, New Hampshire. After design traffic loading was exceeded, pavement failure occurred as expected in the thinner full-depth section. The thinner reduced subgrade strength section was still in good condition after experiencing twice its design loading. Frost penetrations, pavement n-factors (surface transfer coefficients), Benkelman Beam deflections, and the spring subgrade moisture contents are also compared for the two designs.

MP 1493

CONTINUOUSLY DEFORMING FINITE ELEMENTS FOR THE SOLUTION OF PARABOLIC PROBLEMS, WITH AND WITHOUT PHASE CHANGE.

Lynch, D.R., et al, *International journal for numerical methods in engineering*, 1981, Vol.17, p.81-96, 27 refs.
O'Neill, K.
36-2159
FREEZE THAW CYCLES, STEFAN PROBLEM, LIQUID SOLID INTERFACES, LATENT HEAT, BOUNDARY VALUE PROBLEMS, PHASE TRANSFORMATIONS, HEAT TRANSFER, TEMPERATURE EFFECTS, ANALYSIS (MATHEMATICS).

MP 1494

APPROXIMATE SOLUTION TO NEUMANN PROBLEM FOR SOIL SYSTEMS.

Lunardini, V.J., et al, *Journal of energy resources technology*, Mar. 1981, 103(1), p.76-81, 12 refs.
Varotta, R.
36-2256
SOIL TEMPERATURE, HEAT BALANCE, FREEZE THAW CYCLES, BOUNDARY LAYER, PHASE TRANSFORMATIONS, THERMAL PROPERTIES, TEMPERATURE EFFECTS, ANALYSIS (MATHEMATICS).

An approximate solution to the Neumann problem has been obtained by using the heat balance integral method. The accuracy of the solution is shown to be very good for all practical soil system cases. The thermal properties of soil systems are also expressed in terms of only the liquid volumetric fraction and combine with the approximate solution to give a rapid, accurate solution for freeze/thaw problems without using graphs, tables, or transcendental equations. A simple relation is also given for the analogous problem in cylindrical coordinates, but its range of validity is somewhat limited.

MP 1495

ACOUSTIC EMISSIONS DURING CREEP OF FROZEN SOILS.

Fish, A.M., et al, *American Society for Testing and Materials. Special technical publication*, 1982, No.750, p.194-206, 18 refs.
Sayles, F.H.
36-2402
FROZEN GROUND PHYSICS, FROZEN GROUND STRENGTH, SOIL CREEP, ACOUSTICS, RHEOLOGY, STRESSES, COMPRESSIVE PROPERTIES, SOIL FREEZING, DEFORMATION.

Deformation, time-dependent failure, and acoustic emissions during unconfined compression tests of frozen Fairbanks silt were studied. Acoustic emissions (AE) are detected when the applied stress exceeds a threshold level. This threshold stress is related to the limit of long-term strength of the frozen soil. Under stress exceeding the limit of the long-term strength, the accumulation of acoustic emissions with time can be correlated with creep deformation; that is, plots of the cumulative number of acoustic pulses versus time have shapes similar to those of creep curves with primary, secondary, and tertiary stages. Such correspondence made it possible to describe both phenomena from the viewpoint of the unified kinetic theory of strength. Experimental data are presented, and unified constitutive equations describing deformations, time-dependent failure, and the accumulation of the acoustic emissions during short-term creep of frozen soils are derived. The time to incipient failure, when the AE rate reaches a minimum, is considered to be the most important characteristic of a creep process. It is shown that this time can be predicted theoretically if the parameters of the AE process and the stress state of the frozen soil are known.

MP 1496

PHASE CHANGE AROUND INSULATED BURIED PIPES: QUASI-STEADY METHOD.

Lunardini, V.J., *Journal of energy resources technology*, Sep. 1981, Vol.103, p.201-207, 13 refs.
36-2401
FREEZE THAW TESTS, UNDERGROUND PIPELINES, HEAT TRANSFER, STEFAN PROBLEM, PHASE TRANSFORMATIONS, PIPELINE INSULATION, THERMAL INSULATION, ANALYSIS (MATHEMATICS).

The heat transfer problem for cylinders embedded in a medium with variable thermal properties cannot be solved excatly if phase change occurs. Approximate solutions have been found using the quasi-steady method. The temperature field, phase change location, and pipe surface heat transfer can be estimated using graphs presented for parametric ranges of temperature, thermal properties, burial depth, and insulation thickness. The accuracy of the graphs increases as the Stefan number decreases and they should be of particular value for insulated hot pipes or refrigerated gas lines.

MP 1497

HIGHLY EFFICIENT, OSCILLATION FREE SOLUTION OF THE TRANSPORT EQUATION OVER LONG TIMES AND LARGE SPACES.

O'Neill, K., *Water resources research*, Dec. 1981, 17(6), p.1665-1675, 28 refs.
36-2428
SOLUTIONS, FLUID FLOW, DIFFUSION, CONVECTION, TIME FACTOR, ANALYSIS (MATHEMATICS).

MP 1498

VENTING OF BUILT-UP ROOFING SYSTEMS.

Tobiasson, W., Conference on Roofing Technology, 6th, Gaithersburg, MD, Apr. 30-May 1, 1981. Proceedings, 1981, p.16-21, 12 refs.
38-3981
ROOFS, VENTILATION, THERMAL INSULATION, MOISTURE, DRYING, DRAINS, VAPOR BARRIERS.

Table 1 summarizes the information presented in this paper. The following rules of thumb are offered: 1. Bituminous built-up membranes should be vented during construction to allow excess moisture to dissipate. 2. Do not rely on venting above wet-applied decks or wet-applied insulations to dry them. 3. Allow wet-applied decks and wet-applied insulations to dry into the space below. 4. To make roofing systems less vulnerable to moisture problems avoid using moisture-sensitive materials for the bottom ply of a membrane. 5. There is no reason to vent the insulation of a roof lacking a vapor retarder. In fact, venting such roofs may do more thermal and moisture harm than good. 6. When a vapor retarder is required, focus money and efforts that might be spent on vents to improving the quality of the vapor retarder. 7. Do not expect to be able to encapsulate insulation in a vapor tight, pressurizable envelope. Consequently, do not worry too much about creating excess pressures within the roofing system (except within the membrane itself). 8. Do not expect to be able to dry out wet insulation in compact roofs by venting. 9. Some drying of wet fibrous glass insulation is possible by draining away water.

MP 1499

CRREL FROST HEAVE TEST, USA.

Chamberlain, E.J., et al, *Frost i jord*, Nov. 1981, No.22, p.55-62, 7 refs.
Carbee, D.L.
36-2480
FROST RESISTANCE, SOIL FREEZING, FROST HEAVE, MEASURING INSTRUMENTS, TEMPERATURE EFFECTS, TESTS.

The CRREL frost heave test for determining the frost susceptibility of soils and granular base materials is described. The CRREL test is conducted with a constant rate of frost penetration of 1.3 cm/day with water freely avaible. The frost susceptibility classification system is based on the average rate of heave for 12 days. A summary of nearly 400 tests is given to show the wide range of results for similar materials. A summary of the U.S. Army Corps of Engineers Frost Design Classification System is also given to show for what materials the frost heave test is required.

MP 1500

OVERVIEW OF SEASONAL SNOW METAMORPHISM.

Colbeck, S.C., *Reviews of geophysics and space physics*, Feb. 1982, 20(1), p.45-61, 43 refs., Presented at the U.S.-Canadian Workshop on the Properties of Snow, Snowbird, Utah, April 8-10, 1981.
36-2533
SNOW PHYSICS, METAMORPHISM (SNOW), SNOW COVER STRUCTURE, SNOW WATER CONTENT.

The grains in seasonal snow undergo rapid and radical transformations in size, shape, and cohesion. These grain characteristics affect all of the basis properties of snow. Snow is characterized as either wet or dry depending on the presence of liquid water. Wet snow is markedly different at low and high liquid contents. Dry snow is characterized as either an equilibrium form or a kinetic growth form; that is, it is either well rounded or faceted. Of course, many snow grains display either transitional features between two of these categories or features which arise from other processes. Snow is classified depending on the dominant processes of its metamorphism.

MP 1501

PREDICTION OF ICE GROWTH AND CIRCULATION IN KACHEMAK BAY, BRADLEY LAKE HYDROELECTRIC PROJECT.

Daly, S.F., Bradley Lake Hydreolectric Project, Alaska; environmental impact statement—Appendixes. Anchorage, U.S. Army Corps of Engineers, March 1982, p.(C)1-(C)9.
36-2575
ICE GROWTH, OCEAN CURRENTS, SEA ICE DISTRIBUTION, ENVIRONMENTAL IMPACT, ELECTRIC POWER, SUSPENDED SEDIMENTS, UNITED STATES—ALASKA—KACHEMAK BAY.

MP 1502

HISTORICAL SHORELINE CHANGES ALONG THE OUTER COAST OF CAPE COD.

Gatto, L.W., Environmental geologic guide to Cape Cod National Seashore. Edited by S.P. Leatherman, Amherst, University of Massachusetts, 1979, p.69-90, 9 refs.
36-2573
SHORELINE MODIFICATION, SHORE EROSION, PHOTOINTERPRETATION, WATER LEVEL, AERIAL SURVEYS, HISTORY.

The objectives of this investigation were to analyze past patterns of shoreline change, estimate the amounts of change in the positions of the high water line and sea cliff break and base, and estimate rates of accretion and erosion. Distances from selected reference points to the high water line, cliff break, and cliff base were measured using photointerpretation techniques on black and white 9 x 9 in. aerial photographs acquired in 1938, 1952, 1971 and 1974. The amounts and rates of change are calculated for the intervals between the dates of photo acquisition and for the total period from 1938 to 1974.

MP 1503

HISTORICAL SHORELINE CHANGES AS DETERMINED FROM AERIAL PHOTOINTERPRETATION.

Gatto, L.W., Remote Sensing Symposium, Reston, Va., Oct. 29-31, 1979. Proceedings. U.S. Army Corps of Engineers, [1980], p.167-170.

36-2577

SHORELINE MODIFICATION, SHORE EROSION, PHOTOINTERPRETATION, AERIAL SURVEYS, PHOTOGRAMMETRY.

The protection and preservation of shorelines and coastal areas along oceans, lakes, reservoirs and rivers have become increasingly important with more intensive use and development of these areas by the growing population. Shoreline erosion and subsequent shoreline recession are of primary concern since they cause property loss, changes in shoreline habitats and degraded water quality. USACRREL has been investigating many of the complex erosion processes, site specific rates of erosion and problems caused by shoreline erosion. As an integral part of these comprehensive investigations, historical and recent aerial photographs have been used to document historical shoreline characteristics and conditions, to determine past patterns of regional shoreline changes, to monitor the areal extent of shoreline erosion, and to estimate the historical rates of change in shoreline positions.

MP 1504

POTHOLES: THE PROBLEM AND SOLUTIONS.

Eaton, R.A., *Military engineer*, Apr. 1982, 74(479), p.160-162.

36-3938

PAVEMENTS, DAMAGE, ROAD MAINTENANCE, FREEZE THAW CYCLES, DRAINAGE, FROST HEAVE, FATIGUE (MATERIALS), PRECIPITATION (METEOROLOGY), CRACKS.

MP 1505

ROOF MOISTURE SURVEYS.

Tobiasson, W., *Military engineer*, Apr. 1982, 47(479), p.163-166, 4 refs.

36-4011

ROOFS, WATERPROOFING, MOISTURE DETECTION, DRAINAGE, INFRARED PHOTOGRAPHY, LEAKAGE.

MP 1506

OVERLAND FLOW: AN ALTERNATIVE FOR WASTEWATER TREATMENT.

Martel, C.J., et al, *Military engineer*, Apr. 1982, 47(479), p.181-184, 6 refs.

Lee, C.R.

36-4010

WASTE TREATMENT, WATER TREATMENT, RUNOFF, LAND RECLAMATION, SLOPE ORIENTATION.

MP 1507

PHASE CHANGE AROUND A CIRCULAR CYLINDER.

Lunardini, V.J., *Journal of heat transfer*, Aug. 1981, 103(3), p.598-600, 14 refs.

36-2619

PHASE TRANSFORMATIONS, PIPES (TUBES), HEAT TRANSFER, FREEZE THAW CYCLES, FROZEN GROUND PHYSICS, BOUNDARY LAYER, HEAT BALANCE, ANALYSIS (MATHEMATICS).

MP 1508

MAINTAINING BUILDINGS IN THE ARCTIC.

Tobiasson, W., et al, *Batiment international. Building research and practice*, July-Aug. 1977, 5(4), p.244-251, In English and French.

Flanders, S.N., Korhonen, C.

36-2638

THERMAL INSULATION, BUILDINGS, HEAT TRANSFER, MOISTURE TRANSFER, MAINTENANCE, UREA, LEAKAGE, INFRARED PHOTOGRAPHY, UNITED STATES—ALASKA.

Close interest in the work of CIB working commission W 40 on heat and moisture transfer has prompted the authors, who are scientists working with the US Army Cold Regions Research and Engineering Laboratory, to send us these two summaries of remedial work on houses in Alaska. The first indicates the scope for simple injection of urea formaldehyde foam to improve thermal insulation of old wood-frame buildings; the second shows how infra-red photography can cut the cost of repairs to leaking roofs.

MP 1509

CAN WET ROOF INSULATION BE DRIED OUT.

Tobiasson, W., et al, Thermal insulation materials and systems for energy conservation in the '80s, edited by F.A. Govan, *D.M. Greason and J.D. McAllister*, Philadelphia, American Society for Testing and Materials, 1983, p.626-639, ASTM STP 789, 11 refs.

Korhonen, C., Coutermarsh, B.A., Greatorex, A.

38-3980

ROOFS, THERMAL INSULATION, MOISTURE, DRYING, VENTILATION, VAPOR BARRIERS.

Nondestructive techniques are being widely used to locate wet insulation in compact roofing systems. Now that wet insulation can be found, breather vents and so-called "breathable" membranes are being promoted to dry out wet insulation, thereby recovering its thermal effectiveness. Our exposure tests in New Hampshire indicate that the above venting methods are all rather ineffective in drying sealed specimens of perlite and fibrous glass roof insulation. It would take many decades to dry our specimens at the rates we measured over the past two years. Cross-ventilation within the insulation increased the rate of drying. For perlite insulation, the faster rate would still result in a drying time measured in decades. For fibrous glass insulation, the drying time was reduced to 13 years. We have succeeded in drying fibrous glass insulation in a roof by removing the water with a vacuum cleaner.

MP 1510

SNOW COVER MAPPING IN NORTHERN MAINE USING LANDSAT DIGITAL PROCESSING TECHNIQUES.

Merry, C.J., et al, Satellite hydrology. Annual William T. Pecora Memorial Symposium, 5th, American Water Resources Association, June 1979, p.197-198, Summary only.

McKim, H.L., Bates, R.E., Ungar, S.G., Cooper, S., Power, J.M.

36-2843

VEGETATION, SNOW COVER DISTRIBUTION, SNOW WATER EQUIVALENT, SNOW DEPTH, MAPPING, LANDSAT.

MP 1511

VEGETATION SELECTION AND MANAGEMENT FOR OVERLAND FLOW SYSTEMS.

Palazzo, A.J., et al, Land treatment of municipal wastewater. Edited by F.M. D'Itri, Sevenoaks, England, Butterworths, 1982, p.135-154, 19 refs.

Jenkins, T.F., Martel, C.J.

36-2749

WASTE TREATMENT, WATER TREATMENT, LAND RECLAMATION, VEGETATION, GROWTH, NUTRIENT CYCLE, AGRICULTURE.

MP 1512

CONFIGURATION OF ICE IN FROZEN MEDIA.

Colbeck, S.C., *Soil science*, Feb. 1982, 133(2), p.116-123, 9 refs.

36-2865

ICE CRYSTAL STRUCTURE, ICE CRYSTAL GROWTH, GROUND ICE, SANDS, ICE AIR INTERFACE, POROSITY, WATER CONTENT, HEAT TRANSFER, MASS FLOW, EXPERIMENTATION.

The configuration and fabrics of ice in frozen glass beads and sands with a low initial water content were observed. As suggested by Miller, the air-ice interface is convex, and pores seem to fill unstably. This produces an uneven ice distribution when the water supply is limited. Many different ice shapes and crystal distributions were observed, indicating a mixture of kinetic crystal growth processes and equilibrium constraints. Ice dendrites arose from rapid growth. Both single and multicrystalline structures were found. Clearly, a wide variety of situations is possible, depending on growth rates, nucleation sites, and local paths of heat and mass flow.

MP 1513

SOME FIELD STUDIES OF THE CORRELATION BETWEEN ELECTROMAGNETIC AND DIRECT CURRENT MEASUREMENTS OF GROUND RESISTIVITY.

Arcone, S.A., *American Society for Testing and Materials. Special technical publication*, 1982, No.741, p.92-110, 11 refs.

36-2748

SOIL PHYSICS, ELECTRICAL RESISTIVITY, ELECTROMAGNETIC PROSPECTING, PERMAFROST PHYSICS, MAGNETIC SURVEYS, ELECTRIC FIELDS, GROUND ICE.

Electromagnetic (em) and direct-current (d-c) methods of measuring ground resistivity have been compared at permafrost and nonpermafrost sites. The em methods utilized the principles of magnetic induction and plane wave surface impedance. Layered ground models were derived from the d-c sounding data, and the theoretical values of the em methods for these models were compared with the em field results. Both em methods correlated well with the d-c data in the two cases of simple, multilayered ground of large extent. In several cases of resistive inhomogeneities, the magnetic induction data correlated well with the d-c data. In one case of a resistive inhomogeneity, the surface impedance responded well only qualitatively and may have given some false indications of resistive substructure. It appears that in all cases where the volume of exploration was comparable, there was reasonable correlation. It is estimated that the standard data analysis procedure which assumes layering of infinite extent will apply well for the surface impedance method when disturbances in the local layering are greater than a skin depth away from the point of measurement; and for the magnetic induction method when disturbances in the layering are at a distance from the interloop axis that is greater than the interloop separation.

MP 1514

MULTI-YEAR PRESSURE RIDGES IN THE CANADIAN BEAUFORT SEA.

Wright, B., et al, *Coastal engineering*, Oct. 1981, 5(2/3), p.125-145, For another source of the article and abstract see 33-4609 (MP 1229). 16 refs.

Hnatiuk, J., Kovacs, A.

36-3745

SEA ICE, PRESSURE RIDGES, ICE STRUCTURE, MODELS.

MP 1515

DESIGN AND USE OF THE CRREL INSTRUMENTED VEHICLE FOR COLD REGIONS MOBILITY MEASUREMENTS.

Blaisdell, G.L., *SAE technical paper series*, 1982, No.820217, International Congress and Exposition, Detroit, Michigan, Feb.22-26, 1982, 11p., 2 refs.

36-2755

TRACTION, COLD WEATHER OPERATION, TIRES, SURFACE PROPERTIES, RUBBER SNOW FRICTION, INTERFACES, VEHICLES, TESTS, COMPUTER APPLICATIONS.

The U.S. Army Cold Regions Research and Engineering Laboratory has recently acquired an instrumented vehicle for the measurement of forces at the tire/surface material interface. The CRREL instrumented vehicle (CIV) is equipped with moment-compensated triaxial load cells mounted in the front wheel assemblies. Forces are measured in the vertical, longitudinal (in the direction of motion) and side directions. In addition, accurate wheel and vehicle speeds and rear axle torque and speed are measured. Modifications to the vehicle to facilitate the performance of traction and motion resistance tests include four lock-out type hubs to allow front-, rear- or four-wheel drive and a dual brake system for front-, rear- or four-wheel braking. A minicomputer-based data acquisition system is installed in the vehicle to control data collection and for data processing, analysis, and display. Discussion of the vehicle includes its operation and use for the evaluation of the tire performance and surface material properties of motion resistance and traction.

MP 1516

MEASUREMENT OF SNOW SURFACES AND TIRE PERFORMANCE EVALUATION.

Blaisdell, G.L., et al, *SAE technical paper series*, 1982, No.820346, International Congress and Exposition, Detroit, Michigan, Feb. 22-26, 1981, 7p., 8 refs.

Harrison, W.L.

36-2756

RUBBER SNOW FRICTION, SNOW SURFACE, TRACTION, VEHICLES, ANALYSIS (MATHEMATICS).

Research on vehicle mobility in snow has recently become significantly updated by the use of instrumented vehicles. Utilizing triaxial load cells in the front wheel assemblies, the vehicles are capable of measuring the traction and motion resistance forces located at the tire/snow interface. Based on these measured quantities, snow surface characterization parameters are developed. Also, using an energetics approach, a tire performance parameter is developed which offers a measure of the slip-shear energy expended by a tire moving a unit distance. This paper presents the methods, equipment and philosophy followed by the authors in evaluating tire performance in a shallow snow cover. Definitions of terms are contained in the Appendix.

MP 1517

ON THE DIFFERENCES IN ABLATION SEASONS OF ARCTIC AND ANTARCTIC SEA ICE.

Andreas, E.L., et al, *Journal of the atmospheric sciences*, Feb. 1982, 39(2), p.440-447, 41 refs.

Ackley, S.F.

36-2836

SEA ICE, ICE MELTING, ABLATION, METEOROLOGICAL FACTORS.

Arctic sea ice is freckled with melt ponds during the ablation season; Antarctic sea ice has few, if any. On the basis of a simple surface heat budget, the authors investigate the meteorological conditions necessary for the onset of surface melting in an attempt to explain these observations. The low relative humidity associated with the relatively dry winds off the continent and an effective radiation parameter smaller than that characteristic of the Arctic are primarily responsible for the absence of melt features in the Antarctic. Together these require a surface-layer air temperature above 0C before Antarctic sea ice can melt. A ratio of the bulk transfer coefficients less than 1 also contributes to the dissimilarity in Arctic and Antarctic ablation seasons. The effects of wind speed and of the sea-ice roughness on the absolute values of bulk transfer coefficients seem to moderate regional differences, but final assessment of this hypothesis awaits better data, especially from the Antarctic. (Auth.)

MP 1518

SEDIMENT LOAD AND CHANNEL CHARACTERISTICS IN SUBARCTIC UPLAND CATCHMENTS.

Slaughter, C.W., et al, *Journal of hydrology (New Zealand)*, 1981, 20(1), p.39-48, 12 refs.

Collins, C.M.

36-2830

DISCONTINUOUS PERMAFROST, CHANNELS (WATERWAYS), GEOMORPHOLOGY, SEDIMENT TRANSPORT, HYDROLOGY, DRAINAGE, SUSPENDED SEDIMENTS, WATERSHEDS, STATISTICAL ANALYSIS.

Sediment load in low-order streams of the unglaciated Yukon-Tanana Uplands of central Alaska may be related to drainage basin characteristcs and to stream channel morphology. This has been investigated by analysis of selected physical hydrological and water quality data for the 104 sq km Caribou-Poker Creeks Research Watershed, located at 65 deg. 09 min N, 147 deg. 30 min W in a region of rolling to steep uplands and discontinuous permafrost. Channel morphology data are available for first-, second- and third-order streams. Sediment load for selected points was determined over 45 weeks during summer of 1978 and 1979. Consistent differences in sediment yield, hydrologic regime and channel morphology have been determined between permafrost and non-permafrost drainages.

MP 1519

ROLE OF RESEARCH IN DEVELOPING SURFACE PROTECTION MEASURES FOR THE ARCTIC SLOPE OF ALASKA.

Johnson, P.R., Symposium: Surface Protection through Prevention of Damage (Surface Management); Focus: The Arctic Slope, Anchorage, Alaska, May 17-20, 1977. Proceedings. Edited by M.N. Evans. Anchorage, Alaska State Office, Bureau of Land Management, Mar. 1978, p.202-205.

36-2855

SNOW ACCUMULATION, ENVIRONMENTAL PROTECTION, SNOW ROADS, ICE ROADS, SNOWDRIFTS, WIND FACTORS, SNOW FENCES, UNITED STATES—ALASKA—NORTH SLOPE.

The U.S. Army Cold Regions Research and Engineering Laboratory (USA CRREL) has long conducted research in snow, ice, and permafrost. It also translates foreign language engineering papers and publishes research reports, monographs, and bibliographies. Snow and ice roads and construction pads have been used, primarily on the Arctic Slope, during the last few winters. Some have been successful but problems exist which will require further experience and research to solve. One problem is that of snow supply. Snowfall on the Arctic Slope is limited, particularly early in the season when it is most desired. Few good data are available on total quantities and the time pattern of snowfall but Wyoming Snow Gages, now being installed by a number of government agencies and private organizations, are beginning to provide some data which can be used with some confidence. The snow which falls is often blown off by the strong winds which are common in the area so it is not available where it is needed. Research is under way on equipment and techniques for collecting snow and inducing drifting.

MP 1520

GROUND PRESSURES EXERTED BY UNDERGROUND EXPLOSIONS.

Johnson, P.R., Symposium: Surface Protection through Prevention of Damage (Surface Management); Focus: The Arctic Slope, Anchorage, Alaska, May 17-20, 1977. Proceedings. Edited by M.N. Evans, Anchorage, Alaska State Office, Bureau of Land Management, Mar. 1978, p.284-290, 3 refs.

36-2857

FROZEN GROUND STRENGTH, ENVIRONMENTAL PROTECTION, SOIL PRESSURE, EXPLOSION EFFECTS, SHOCK WAVES, WAVE PROPAGATION, ENVIRONMENTAL IMPACT, BLASTING, MARINE BIOLOGY, UNITED STATES—ALASKA—NORTH SLOPE.

Peak shock pressures in frozen soil resulting from underground explosions of moderate size and their effect on fish populations are examined, based on current knowledge of shock pressure patterns and the sensitivity of fish eggs and young and adult fish to such pressures. The peak shock pressures attenuate rapidly with distance from explosion and it appears that moderate-sized explosions, such as those from standard seismic shots, can be fired within a few hundred feet of water bodies without exceeding allowable peak shock pressures in the water bodies. Experimental studies should be carried out to confirm the pattern of peak shock pressure attenuation and examine the effectiveness of shock transmission between frozen ground and the water bodies.

MP 1521

USING SEA ICE TO MEASURE VERTICAL HEAT FLUX IN THE OCEAN.

McPhee, M.G., et al, *Journal of geophysical research*, Mar. 20, 1982, 87(C3), p.2071-2074, 8 refs.

Untersteiner, N.

36-2868

SEA ICE, ICE SALINITY, HEAT FLUX, SEA WATER, TEMPERATURE GRADIENTS, ICE GROWTH, DRIFTING STATIONS, WATER TEMPERATURE, SALINITY.

Results of an experiment performed at drifting ice station FRAM I in the Arctic Ocean northwest of Spitzbergen during March-May 1979 indicate that sensible heat flux from the ocean to the ice cover was less than 2 W/sq.m. The estimate is based on measurements of temperature gradient, growth rate, and salinity of young sea ice. Uncertainty in the magnitude of the heat flux results more from evidence of horizontal inhomogeneity in the growing ice sheet than from measurement errors.

MP 1522

APPROACH ROADS, GREENLAND 1955 PROGRAM.

U.S. Arctic Construction and Frost Effects Laboratory, *U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi. Technical report*, June 1959, No.3-505, 100p., For preliminary version see ACFEL TR 60, or 25-2537.

36-2877

PERMAFROST BENEATH ROADS, PERMAFROST THERMAL PROPERTIES, GLACIER FLOW, GLACIER MELTING, ROADS, MAINTENANCE, THAW DEPTH, MELTWATER, ICE TEMPERATURE, ROADBEDS, CONSTRUCTION, GRAVEL, EQUIPMENT, GREENLAND—CAMP TUTO.

MP 1523

BASELINE DATA ON TIDAL FLUSHING IN COOK INLET, ALASKA.

Gatto, L.W., Preliminary analysis report, SR/T contract No.160-75-89-02-10, June 1973, 11p., Unpublished manuscript. 9 refs.

36-2878

TIDAL CURRENTS, SUSPENDED SEDIMENTS, OCEAN CURRENTS, WATER POLLUTION, SEDIMENT TRANSPORT, SEDIMENTATION, REMOTE SENSING, SEASONAL VARIATIONS, UNITED STATES—ALASKA—COOK INLET.

MP 1524

ACOUSTIC EMISSIONS FROM POLYCRYSTALLINE ICE.

St. Lawrence, W.F., et al, *Cold regions science and technology*, Mar. 1982, 5(3), p.183-199, 18 refs.

Cole, D.M.

36-2870

ICE CRYSTAL STRUCTURE, ICE ACOUSTICS, DYNAMIC LOADS, STRESSES, STRAINS, FRACTURING, AIR TEMPERATURE, MATHEMATICAL MODELS, MECHANICAL TESTS.

The acoustic emission response from fine-grained polycrystalline ice subjected to constant compressive loads was examined. A number of tests were conducted with the nominal stress ranging from 0.8 to 3.67 MPa at a temperature of -5C. The acoustic emission response was recorded and the data are presented with respect to time and strain. The source of acoustic emissions in ice is considered in terms of the formation of both microfractures and visible fractures that develop without catastrophic failure of the ice. A model to describe the acoustic emission response is developed.

MP 1525

DEFORMATION AND FAILURE OF ICE UNDER CONSTANT STRESS OR CONSTANT STRAIN-RATE.

Mellor, M., et al, *Cold regions science and technology*, Mar. 1982, 5(3), p.201-219, 8 refs.

Cole, D.M.

36-2871

ICE DEFORMATION, STRESS STRAIN DIAGRAMS, ICE MECHANICS, AIR TEMPERATURE, TESTS, ISOTOPES.

Fine-grained isotopic ice was tested in uniaxial compression at -5C. Tests were made under: 1. Constant strain rate, and 2. Constant stress, with total axial strains up to about 7%. Direct comparison of the results for constant stress and constant strain rate suggests that the two tests give much the same information when interpreted suitably. Detailed comparisons and interpretations of the data will be given in a subsequent paper.

MP 1526

ON MODELING MESOSCALE ICE DYNAMICS USING A VISCOUS PLASTIC CONSTITUTIVE LAW.

Hibler, W.D., III, et al, International Conference on Port and Ocean Engineering under Arctic Conditions, 6th, Québec, Canada, July 27-31, 1981. Proceedings, Vol.3, Québec, Canada, Université Laval, 1981, p.1317-1329, 9 refs. Includes discussion and authors' reply.

Udin, I., Ullerstig, A.

36-2982

ICE MECHANICS, VISCOSITY, ICE PLASTICITY, RHEOLOGY, MATHEMATICAL MODELS, PLASTIC FLOW, ICE COVER THICKNESS, VELOCITY, ICE STRENGTH.

The behavior of an ice dynamics model employing a viscous plastic rheology is investigated. Time and space scales of the order of 3 hours and 20 km are emphasized. However, whenever possible the results are presented in a nondimensional form. Numerical parameter variations examined include the effect of the "rigid" creep rate on numerical convergence rate, the effects of ice strength on the numerical adjustment time needed to fully attain ideal plastic flow, and the effect of grid size on the behavior of simulated ice dynamics. Based on the results of these studies a viable numerical procedure for simulating mesoscale plastic flow is proposed.

MP 1527

SEA ICE RUBBLE FORMATIONS OFF THE NORTHEAST BERING SEA AND NORTON SOUND COASTS OF ALASKA.

Kovacs, A., International Conference on Port and Ocean Engineering under Arctic Conditions, 6th, Québec, Canada, July 27-31, 1981. Proceedings, Vol.3, Québec, Canada, Université Laval, 1981, p.1348-1363, 21 refs.

36-2984

SEA ICE, PRESSURE RIDGES, ICE SURFACE, ICE FORMATION, GROUNDED ICE, PHOTOGRAPHY, AERIAL SURVEYS, UNITED STATES—ALASKA—NORTON SOUND, BERING SEA.

MP 1528

RIVER ICE SUPPRESSION BY SIDE CHANNEL DISCHARGE OF WARM WATER.

Ashton, G.D., IAHR International Symposium on Ice, Québec, Canada, July 27-31, 1981. Proceedings, Vol.1, Québec, Canada, Université Laval, 1982, p.65-80, 3 refs. Includes discussions and replies.

36-3023

RIVER ICE, ICE CONDITIONS, ICE PREVENTION, CHANNELS (WATERWAYS), WATER TEMPERATURE, RIVER FLOW, ICE EDGE, AIR TEMPERATURE, ICE MELTING.

Results are presented of a field study of the ice suppression caused by discharge of warm water at the side of the Mississippi River near Bettendorf, Iowa. Included in the results are measurements of lateral and longitudinal open water extents and lateral, longitudinal, and vertical water temperature profiles. Successive measurements were made on both very cold (-20C) and warm days (0C air temperature). The manner by which the ice cover extends during a change from warm to cold weather is described.

MP 1529

PERFORMANCE OF A POINT SOURCE BUBBLER UNDER THICK ICE.

Haynes, F.D., et al, IAHR International Symposium on Ice, Québec, Canada, July 27-31, 1981. Proceedings, Vol.1, Québec, Canada, Université Laval, 1982, p.111-124, 10 refs. Includes discussions and replies.

Ashton, G.D., Johnson, P.R.

36-3026

ICE COVER THICKNESS, BUBBLING, ICE PREVENTION, ICE MELTING, STRUCTURES, DAMAGE, TESTS, AIR TEMPERATURE, ANALYSIS (MATHEMATICS).

Air bubbler systems are used to suppress ice formation and prevent ice damage to structures. Injection of air into the slightly more dense, warm water at the bottom of a body of fresh water raises the warm water to the surface. A bubbler system provides a simple and inexpensive means of suppressing ice if the body of water has the necessary thermal reserve. A study was conducted with a point source bubbler to examine its performance when installed under an existing layer of thick lake ice.

MP 1530

PORT HURON ICE CONTROL MODEL STUDIES.

Calkins, D.J., et al, IAHR International Symposium on Ice, Québec, Canada, July 27-31, 1981. Proceedings, Vol.1, Québec, Canada, Université Laval, 1982, p.361-373, 6 refs. Includes discussion and authors' reply.
Sodhi, D.S., Deck, D.S.
36-3044

RIVER ICE, ICE CONTROL, ICE JAMS, FLOODS, ICE MECHANICS, LAKE ICE, ICE LOADS, LOADS (FORCES), ICE FLOES, WIND PRESSURE, STRUCTURES, MODELS, UNITED STATES—SAINT CLAIR RIVER.

The Corps of Engineers, in its study of year-round navigation on the Great Lakes, recognized the problem of ice discharge into St. Clair River from Lake Huron. This study deals with the determination of force levels on, and the amount of ice discharge through the opening in, an ice control structure, using natural and synthetic ice floes.

MP 1531

FORCE DISTRIBUTION IN A FRAGMENTED ICE COVER.

Daly, S.F., et al, IAHR International Symposium on Ice, Québec, Canada, July 27-31, 1981. Proceedings, Vol.1, Québec, Canada, Université Laval, 1982, p.374-387, 2 refs. Includes discussions and authors' replies.
Stewart, D.M.
36-3045

FLOATING ICE, ICE FLOES, LOADS (FORCES), ICE BOOMS, SHEAR STRESS, CHANNELS (WATERWAYS), EXPERIMENTATION.

MP 1532

GLACIER MECHANICS.

Mellor, M., IAHR International Symposium on Ice, Québec, Canada, July 27-31, 1981. Proceedings, Vol.2, Québec, Canada, Université Laval, 1982, p.455-474, Includes discussion.
36-3051

GLACIER FLOW, ICE CREEP, ICE MECHANICS, STRESS STRAIN DIAGRAMS, RHEOLOGY, ENGINEERING.

MP 1533

FIELD INVESTIGATIONS OF A HANGING ICE DAM.

Beltaos, S., et al, IAHR International Symposium on Ice, Québec, Canada, July 27-31, 1981. Proceedings, Vol.2, Québec, Canada, Université Laval, 1982, p.475-488, 19 refs. Includes discussions and replies.
Dean, A.M., Jr.
36-3052

RIVER ICE, ICE DAMS, ICE BREAKUP, FRAZIL ICE, SHEAR STRENGTH, UNDERWATER ICE, SLUSH, BEARING STRENGTH, ICE JAMS, DAMAGE, FLOW RATE, POROSITY.

A hanging ice dam that forms annually in the lower Smoky River, Alberta, has been the object of continued investigation during the period 1975-1979. The study aims at documenting physical dimensions and material properties of the dam; elucidating the mechanisms of its formation and removal; and assessing its effects on the progress of breakup in the river. This paper presents a summary of the results obtained to date.

MP 1534

PROBABILISTIC-DETERMINISTIC ANALYSIS OF ONE-DIMENSIONAL ICE SEGREGATION IN A FREEZING SOIL COLUMN.

Guymon, G.L., et al, *Cold regions science and technology,* Nov. 1981, 5(2), p.127-140, 14 refs.
Harr, M.E., Berg, R.L., Hromadka, T.V., II.
36-3231

FROST HEAVE, SOIL FREEZING, HEAT TRANSFER, SOIL WATER MIGRATION, ICE FORMATION, WATER CONTENT, MATHEMATICAL MODELS.

A deterministic model of frost heave based upon simultaneous analysis of coupled heat and moisture transport is cascaded with a probabilistic model of parameter variations. The multiparameter, deterministic model is based upon submodels of moisture transport, heat transport, and lumped isothermal freezing processes. The probabilistic model is based upon Rosenblueth's method which only requires knowledge of parameter means and their coefficients of variation.

MP 1535

APPLICATION OF A NUMERICAL SEA ICE MODEL TO THE EAST GREENLAND AREA.

Tucker, W.B., Monterey, California, Naval Postgraduate School, Dec. 1981, 109p., M.S. thesis. Refs. p.104-106.
36-3254

SEA ICE DISTRIBUTION, DRIFT, ICE GROWTH, THERMODYNAMICS, MATHEMATICAL MODELS, GREENLAND.

A dynamic-thermodynamic sea ice model which employs a viscous-plastic constitutive law has been applied to the East Greenland area. The model is run on a 40-km spatial scale at 1/4-day time steps for a 60-day period with forcing data beginning on Oct. 1, 1979. Results tend to verify that the model predicts reasonable thicknesses and velocities within the ice margin. Thermodynamic ice growth produces excessive ice extent, however, probably due to inadequate parameterization of oceanic heat flux.

MP 1537

ICE CRYSTAL MORPHOLOGY AND GROWTH RATES AT LOW SUPERSATURATIONS AND HIGH TEMPERATURES.

Colbeck, S.C., *Journal of applied physics,* May 1983, 54(5), p.2677-2682, 17 refs.
37-3607

ICE CRYSTAL STRUCTURE, ICE CRYSTAL GROWTH, SUPERSATURATION, TEMPERATURE EFFECTS, VAPOR DIFFUSION, DENSITY (MASS/VOLUME), MATHEMATICAL MODELS.

At an excess vapor density (supersaturation of about 1/10,000) adjacent to the ice crystal surface of 50-60 billionth g/cc, there is a transition between the highly faceted kinetic growth form and the rounded equilibrium form at temperatures above -6C. At lover temperatures there is a transition in the equilibrium form to hexagonal prisms because of a reduction in the disordered surface layer. The growth rate of ice crystals from the vapor is analyzed by a simple model which accounts for vapor flow and surface processes separately. The conditions for highly temperature sensitive growth are identified from the model.

MP 1538

ICE PILE-UP AND RIDE-UP ON ARCTIC AND SUBARCTIC BEACHES.

Kovacs, A., et al, *Coastal engineering,* Oct. 1981, 5(2/3), p.247-273, For another source of the article and abstract see 33-4610 (MP 1230). 22 refs.
Sodhi, D.S.
36-3746

SEA ICE, PRESSURE RIDGES, ICE PUSH.

MP 1539

FORMATION OF ICE CRYSTALS AND DISSIPATION OF SUPERCOOLED FOG BY ARTIFICIAL NUCLEATION, AND VARIATIONS OF CRYSTAL HABIT AT EARLY GROWTH STAGES.

Kumai, M., *Journal of applied meteorology,* Apr. 1982, 21(4), p.579-587, 14 refs.
36-3898

FOG DISPERSAL, ICE CRYSTAL NUCLEI, ARTIFICIAL NUCLEATION, SUPERCOOLED FOG, MICROSTRUCTURE, ELECTRON MICROSCOPY, PLATES, ICE FORMATION, WATER VAPOR, TEMPERATURE EFFECTS.

The early stages of ice crystal formation in supercooled fogs were studied in detail by electron microscopy, and ice nucleation experiments using liquid propane seeding were conducted in a thermostatically controlled coldroom. Ice crystals, formed by rapid cooling created by the evaporation of liquid propane from a fine nozzle at temperatures from -0.1 to -40C, were collected and replicated on filmed grids for electron microscope examinations. Most of the ice crystals formed immediately after the liquid propane seedings were spherical (although approx. 20% were hexagonal) with diameters ranging from 0.3 to 3 micrometer and with a mean diameter of 1.5 micrometer. Electron microscopy revealed a grain boundary in some of the ice crystals.

MP 1540

RESISTANCE COEFFICIENTS FROM VELOCITY PROFILES IN ICE-COVERED SHALLOW STREAMS.

Calkins, D.J., et al, *Canadian journal of civil engineering,* June 1982, 9(2), p.236-247, With French summary. 7 refs.
Deck, D.S., Martinson, C.R.
36-3929

ICE COVER STRENGTH, STREAM FLOW, VELOCITY, SHEAR STRESS, ANALYSIS (MATHEMATICS).

MP 1541

NITROGENOUS CHEMICAL COMPOSITION OF ANTARCTIC ICE AND SNOW.

Parker, B.C., et al, *Antarctic journal of the United States,* 1981, 16(5), p.79-81, 10 refs.
Zeller, E.J., Gow, A.J.
36-3979

ICE COMPOSITION, SNOW COMPOSITION, FIRN, CHEMICAL ANALYSIS, ANTARCTICA—AMUNDSEN-SCOTT STATION, ANTARCTICA—VOSTOK STATION.

This report emphasizes nitrate ion (NO3) concentrations in antarctic snow and firn from pits and cores. Chemical analyses conducted or planned on antarctic snow, firn, and ice are outlined. Computer curves compare the variation in NO3 over the past 1,000 yr in firn cores from South Pole Station and Vostok and present the NO3 concentration record for the entire Vostok core over the past 3,000 yr. South Pole firn core dates have been calculated using data which date back to 1750. Fourier analysis of the NO3 data from both South Pole and Vostok cores reveals strong periodicities in the NO3 concentration occurring at approx 11-, 22-, and 66-yr intervals. Data have previously been reported supporting the hypothesis that the 11-yr fluctuations in NO3 either coincide with the solar activity max or the auroral max. A table lists 14 potential sources or mechanisms for NO3 in antarctic snow or firn. Solar-mediated phenomena appear to be the more likely sources. The results of NO3 sampling in a 10-m-deep snowpit are discussed.

MP 1542

PHYSICAL AND STRUCTURAL CHARACTERISTICS OF SEA ICE IN MCMURDO SOUND.

Gow, A.J., et al, *Antarctic journal of the United States,* 1981, 16(5), p.94-95, 5 refs.
Weeks, W.F., Govoni, J.W., Ackley, S.F.
36-3988

SEA ICE, ICE STRUCTURE, PHYSICAL PROPERTIES, CALVING, ANTARCTICA—MCMURDO SOUND.

This season's study of the physical and structural properties of sea ice in McMurdo Sound was restricted to sea ice that had formed since Apr. 1980. Multiyear ice was observed and sampled at only one location, near Cape Chocolate on the western edge of McMurdo Sound. The locations of the sample sites are shown. The sampling program included an over-ice traverse of the bay-fast ice in McMurdo Sound. Extensive recent calving of the Koettlitz Glacier ice tongue was observed in the vicinity of the Dailey Is. Preliminary investigations of the crystal structure of samples from 28 locations revealed widespread formation of congelation ice but only minimal amounts of frazil ice. Formation of a sub-ice platelet layer with individual plates measuring up to several cm in length was observed at the majority of sampling sites. Petrographic studies revealed crystalline structures and c-axis orientations that exhibited much in common with shore-fast ice of the arctic coast of Alaska.

MP 1543

HIGH-RESOLUTION IMPULSE RADAR MEASUREMENTS FOR DETECTING SEA ICE AND CURRENT ALINEMENT UNDER THE ROSS ICE SHELF.

Morey, R.M., et al, *Antarctic journal of the United States,* 1981, 16(5), p.96-97, 5 refs.
Kovacs, A.
36-3989

SEA ICE, RADAR ECHOES, ICE SHELVES, ANTARCTICA—ROSS ICE SHELF.

The objectives of the Jan. 1981 field season were (1) to evaluate the feasibility of using a high-resolution impulse radar profiling system to detect the existence of sea ice which coring had revealed on the bottom of the Ross Ice Shelf at J-9, and 2) if successful in that effort, to try to detect the preferred horizontal C-axis azimuthal direction of the sea ice crystals using the voltage amplitude of the radar reflection. The instrumentation used is described. A table lists the radar parameters used for calculating the maximum radar range, and the maximum radar range for the two antennas used is plotted. The results obtained with the radar system were inconclusive, and several possible explanations are outlined. Brine infiltration into the McMurdo Ice Shelf was also investigated.

MP 1544

ROLE OF PLASTIC ICE INTERACTION IN MARGINAL ICE ZONE DYNAMICS.

Leppäranta, M., et al, *Journal of geophysical research,* Nov. 20, 1985, 90(C6), p.11,899-11,909, 17 refs.
Hibler, W.D., III.
40-4615

ICE EDGE, SEA ICE, ICE COVER THICKNESS, PLASTIC FLOW, WIND DIRECTION, WIND VELOCITY, ICE MODELS.

Under appropriate conditions, the nonlinear nature of plastic ice interaction together with a nonlinear coupling between ice thickness characteristics and ice rheology can substantially modify the character of marginal ice zone dynamics. This paper examines the steady state ramifications of these nonlinearities by using a one-dimensional simplification of a two-level viscous plastic sea ice model. A series of idealized small-scale simulations (4-km resolution) is carried out with the model formulated in a moving Lagrangian grid in order to remove diffusion effects. Analytic solutions for the equilibrium plastic adjustment case are also constructed. The results show that if the ice thickness distribution is allowed to equilibrate in response to a constant wind field, the thickness strength coupling will yield a sharp ice edge, with the compactness dropping rapidly to zero near the ice margin. (Auth. mod.)

MP 1545

GEOMETRY AND PERMITTIVITY OF SNOW AT HIGH FREQUENCIES.

Colbeck, S.C., *Journal of applied physics,* June 1982, 53(6), p.4495-4500, 37 refs.
36-3921

SNOW ELECTRICAL PROPERTIES, SNOW DENSITY, POROSITY, SNOW CRYSTAL STRUCTURE, SNOW PHYSICS, TEMPERATURE GRADIENTS, LIQUID PHASES, WET SNOW, DIELECTRIC PROPERTIES.

The geometry and porosity of dry snow varies widely depending on the history of conditions. The permittivity of dry snow increases with increasing ice content but is not greatly affected by the shapes of the ice particles. In wet snow the permittivity increases with liquid content and the geometry is very important. However, the liquidlike layer has little effect on permittivity. The permittivity is described using Polder and van Santen's mixing formulae and approximations of the geometries at high and low liquid contents. It is shown that the common assumption of liquid shells over ice spheres is both physically incorrect and leads to large errors.

MP 1546
ENVIRONMENTAL AND SOCIETAL CONSEQUENCES OF A POSSIBLE CO2-INDUCED CLIMATE CHANGE: VOLUME 2, PART 3—INFLUENCE OF SHORT-TERM CLIMATE FLUCTUATIONS ON PERMAFROST TERRAIN.
Brown, J., et al, *U.S. Office of Energy Research. [Report]*, May 1982, Vol.2, 30p., Refs. p.25-28.
Andrews, J.T.
36-4051
PERMAFROST DEPTH, VEGETATION, CARBON DIOXIDE, CLIMATIC CHANGES, GROUND THAWING, SOIL TEMPERATURE.

MP 1547
DIELECTRIC PROPERTIES OF THAWED ACTIVE LAYERS OVERLYING PERMAFROST USING RADAR AT VHF.
Arcone, S.A., et al, *Radio science*, May-June 1982, 17(3), p.618-626, 17 refs.
Delaney, A.J.
37-3
DIELECTRIC PROPERTIES, ACTIVE LAYER, GROUND THAWING, PERMAFROST BASES, RADAR ECHOES.

Field measurements of the dielectric constant of thawed active layers of up to 1 m in depth at four sites in Alaska have been made using short-pulse ground radar whose returns were received in the near-field radiation zone. Three sites consisted of saturated silts with varying amounts of organic material, and the fourth site was a moist sand. The reflector returning the radar signals was the active layer/permafrost interface. Analysis of the waveforms showed that all the materials were nondispersive over the radar pulse bandwidth (75-225 MHz), and this was confirmed by time domain reflectometry (TDR) studies of field samples. The average dielectric constants were between 23 and 34 for the silts, which averaged between 45 and 50% water by volume, while the sandy site gave an average value of about 12 for a probable water content of about 23% by volume. These values are very similar to the laboratory work of others and were also confirmed by TDR. The high dielectric constants of the saturated materials allowed accurate profiling of active layer depth, and an example is presented. More detail would probably be achieved with a higher-frequency radar.

MP 1548
PHYSICAL AND STRUCTURAL CHARACTERISTICS OF ANTARCTIC SEA ICE.
Gow, A.J., et al, *Annals of glaciology*, 1982, Vol.3, International Symposium on Antarctic Glaciology, 3rd, Columbus, Ohio, Sep. 7-12, 1981, p.113-117, 8 refs.
Ackley, S.F., Weeks, W.F., Govoni, J.W.
37-257
ICE FLOES, PACK ICE, FRAZIL ICE, ANTARCTICA—WEDDELL SEA.

Observations during February and March 1980 of structures in 66 separate floes in Weddell Sea pack ice show widespread occurrence of frazil ice in amounts not previously reported in sea ice of comparable age and thickness in the Arctic. It is estimated that as much as 50% of the total ice production in the Weddell Sea is generated as frazil. Average floe salinities also appear higher than those of their Arctic counterparts. Comparative studies of fast ice at 28 locations in McMurdo Sound show this ice to be composed almost entirely of congelation ice that exhibits crystalline textures and orientations that are similar to those observed in Arctic fast ice. However, average fast-ice salinities in McMurdo Sound are higher than those reported for Arctic fast ice of comparable age and thickness. (Auth.)

MP 1549
ON MODELING THE WEDDELL SEA PACK ICE.
Hibler, W.D., III, et al, *Annals of glaciology*, 1982, Vol.3, International Symposium on Antarctic Glaciology, 3rd, Columbus, Ohio, Sep. 7-12, 1981, p.125-130, 23 refs.
Ackley, S.F.
37-259
SEA ICE, PACK ICE, THERMODYNAMIC PROPERTIES, ICE MODELS, ANTARCTICA—WEDDELL SEA.

Some results from a dynamic-thermodynamic simulation of the seasonal cycle of the Weddell Sea pack ice are described. The model used for the study is similar to that developed for a numerical investigation of the Arctic ice cover. It employs a plastic ice rheology coupled to a two-level ice thickness distribution. The thickness characteristics evolve in response to ice dynamics, and to ice growth and decay rates dictated by surface heat calculations and by heat storage in a fixed depth oceanic boundary layer. Observed time-varying wind, temperature, and humidity fields are used together with empirical radiation fields and fixed ocean currents to drive the model. Employing these fields, the model is integrated over two seasonal cycles. Overall, the results suggest that (1) ice dynamics are essential in describing the seasonal cycle, and (2) a feedback between the atmospheric temperature and the presence of ice may be a major cause of the rapid decay of the Antarctic ice cover during the spring-summer period. (Auth. mod.)

MP 1550
BRINE ZONE IN THE MCMURDO ICE SHELF, ANTARCTICA.
Kovacs, A., et al, *Annals of glaciology*, 1982, Vol.3, International Symposium on Antarctic Glaciology, 3rd, Columbus, Ohio, Sep. 7-12, 1981, p.166-171, 21 refs.
Gow, A.J., Cragin, J.H.
37-266
ICE SHELVES, BRINES, MIGRATION, ANTARCTICA—MCMURDO ICE SHELF.

Infiltration of brine into the McMurdo Ice Shelf is dominated by wave-like intrusions of sea-water triggered by periodic break-outs of the ice front. Observations of a brine step 4.4 m in height in the McMurdo Ice Shelf show that it has migrated about 1.2 km in four years. The inland boundary of the brine percolation is probably controlled largely by the depth at which brine encounters the firn/ice transition (43 m). However, this boundary is not fixed by permeability considerations alone, since measurable movement of brine is still occurring at the inland boundary. Freeze-fractionation of the sea-water as it migrates through the ice shelf precipitates virtually all sodium sulfate, and preferentially concomitant removal of water by freezing in the pore spaces of the infiltrated firn produces residual brines approximately seven times more concentrated than the original sea-water. (Auth. mod.)

MP 1551
NITRATE FLUCTUATIONS IN ANTARCTIC SNOW AND FIRN: POTENTIAL SOURCES AND MECHANISMS OF FORMATION.
Parker, B.C., et al, *Annals of glaciology*, 1982, Vol.3, International Symposium on Antarctic Glaciology, 3rd, Columbus, Ohio, Sep. 7-12, 1981, p.243-248, 33 refs.
Zeller, E.J., Gow, A.J.
37-280
SNOW COMPOSITION, SNOW IMPURITIES, PERIODIC VARIATIONS, NITRATE DEPOSITS, ANTARCTICA—EAST ANTARCTICA.

Data are summarized on in situ nitrate ion concentrations in snow pits and firn cores over the last 3,250 a. Nitrate fluctuations show seasonal, 11 and 22 a periodicities, and long-term changes both at South Pole station and Vostok. High nitrate levels conform to winter darkness and solar activity peaks. Long-term lows and highs conform to solar activity minima and maxima. The data available support the hypothesis that nitrate is fixed in the upper atmosphere by some solar-mediated phenomenon causing a periodicity in East Antarctica snow. Background levels and non-periodic spikes in nitrate come from other sources. (Auth.)

MP 1552
SOME RECENT TRENDS IN THE PHYSICAL AND CHEMICAL CHARACTERIZATION AND MAPPING OF TUNDRA SOILS, ARCTIC SLOPE OF ALASKA.
Everett, K.R., et al, *Soil science*, May 1982, 133(5), p.264-280, Refs. p.278-280.
Brown, J.
37-174
TUNDRA, SOIL SURVEYS, PERMAFROST PHYSICS, SLOPE ORIENTATION, SOIL CHEMISTRY, SOIL WATER, SOIL STRUCTURE, SOIL CLASSIFICATION, DISTRIBUTION, MAPPING, UNITED STATES—ALASKA—NORTH SLOPE.

MP 1553
DEFORMATION AND FAILURE OF FROZEN SOILS AND ICE AT CONSTANT AND STEADILY INCREASING STRESSES.
Fish, A.M., Canadian Permafrost Conference, 4th, Calgary, Alberta, Mar. 2-6, 1981. Proceedings, Ottawa, National Research Council of Canada, 1982, p.419-428, With French summary. 16 refs.
37-385
PERMAFROST PHYSICS, FROZEN GROUND STRENGTH, FROZEN GROUND COMPRESSION, FROZEN GROUND MECHANICS, SOIL CREEP, ICE DEFORMATION, ICE STRENGTH, STRESSES, ICE CREEP, ANALYSIS (MATHEMATICS), EXPERIMENTATION.

Experimental and theoretical studies were made of the deformation and time-dependent failure of ice. Uniaxial compression tests were performed in the laboratory at constant and steadily increasing stresses. Strength criteria and unified constitutive equations describing all three stages of creep at constant stress are presented. It is shown that regardless of the stress regime (constant stress or step loading) the equations describe deformation and time-dependent failure by five parameters. The form of the constitutive equations, which can be applied also to describe the mechanical properties of frozen and unfrozen soils, make it possible to obtain analytical solutions of the practical problems and to determine the creep parameters of frozen and unfrozen soils and ice *in situ*.

MP 1554
THEORY OF THERMAL CONTROL AND PREVENTION OF ICE IN RIVERS AND LAKES.
Ashton, G.D., *Advances in hydroscience*, 1982, Vol.13, p.131-185, 38 refs.
37-684
ICE CONTROL, RIVER ICE, LAKE ICE, THERMAL REGIME, HEAT TRANSFER, WATER FLOW, WATER TEMPERATURE, BUBBLING, ICE FORMATION, ICE GROWTH, ICE MELTING, ANALYSIS (MATHEMATICS).

The thermal control of ice in rivers and lakes is accomplished in most cases by modifying the energy budget of the ice cover. In most cases the modification is to increase the flow of heat to the underside of the ice cover, either by directing against it a flow of warm water obtained from other parts of the water body, as in the case of air bubbler systems, or by increasing the temperature of the existing flow of water, as in the case of rivers.

MP 1555
IN-SITU MEASUREMENTS OF THE MECHANICAL PROPERTIES OF ICE.
Tatinclaux, J.C., International Conference on Marine Research, Ship Technology and Ocean Engineering, Hamburg, Sep. 29-30, 1982. Proceedings. Intermaritec '82, Hamburg, 1982, p.326-334, 7 refs.
37-607
ICE MECHANICS, ICE COVER STRENGTH, ICE ELASTICITY, FLEXURAL STRENGTH, FLOATING ICE, ANALYSIS (MATHEMATICS).

Two methods for in-situ determination of the bending strength and elastic modulus of ice are presented. The first method requires failure tests of a series of cantilever beams of various length over thickness ratios, while the second method is based on failure testing of a free-floating beam of length at least three times the ice characteristic length. Both methods avoid the need for measuring beam deflection in order to determine the elastic modulus. The analytical background of the methods is presented, and their advantages and disadvantages as compared to conventional methods are discussed together with their likely application to field or laboratory use.

MP 1556
STANDARDIZED TESTING METHODS FOR MEASURING MECHANICAL PROPERTIES OF ICE.
Schwarz, J., et al, *Cold regions science and technology*, July 1981, 4(3), p.245-254, 18 refs.
Frederking, R., Gavrilo, V.P., Petrov, I.G., Hirayama, K., Mellor, M., Tryde, P., Vaudrey, K.D.
37-872
ICE MECHANICS, COMPRESSIVE PROPERTIES, TENSILE PROPERTIES, ICE ELASTICITY, STANDARDS, LOADS (FORCES), TESTS.

The results of nominally similar tests vary greatly due to the fact that almost every ice research group uses different testing methods. This is of course a hindrance to the Ice Engineering field. In order to improve the quality, comparability and usefulness of the test data resulting from mechanical property investigations, the IAHR Section on Ice Problems considers it necessary to standardize ice testing methods. Herewith the Working Group of the IAHR Section on Ice Problems proposes its recommendation for "Standardized Testing Methods for Measuring Mechanical Properties of Ice." It should be noted that the suggested recommendations remain open to revision as the development of ice testing methods progresses.

MP 1557
FROST SUSCEPTIBILITY OF SOIL; REVIEW OF INDEX TESTS.
Chamberlain, E.J., *U.S. Federal Highway Administration. Interim report*, Aug. 1982, FHWA/RD-82/081, 110p., Refs. p.83-88.
37-973
FROST HEAVE, SOIL MECHANICS, SOIL FREEZING, ICE WATER INTERFACE, ICE SOLID INTERFACE, TESTS, CLASSIFICATIONS, TEMPERATURE GRADIENTS, SOIL WATER, PARTICLE SIZE DISTRIBUTION, GRAIN SIZE.

Methods of determining the frost susceptibility of soils are identified and presented in this report. More than one hundred criteria were found, the most common based on particle size characteristics. These particle size criteria are frequently augmented by information such as grain size distribution, uniformity coefficients and Atterberg limits. Information on permeability, mineralogy and soil classification has also been used. More complex methods requiring pore size distribution, moisture-tension, hydraulic-conductivity, heave-stress, and frost-heave tests have also been proposed. However, none has proven to be the universal test for determining the frost susceptibility of soils. Based on this survey, four methods are proposed for further study. They are the U.S. Army Corps of Engineers Frost Susceptibility Classification System, the moisture-tension hydraulic-conductivity test, a new frost-heave test, and the CBR-after-thaw test.

MP 1558

DESIGNING WITH WOOD FOR A LIGHTWEIGHT AIR-TRANSPORTABLE ARCTIC SHELTER: HOW THE MATERIALS WERE TESTED AND CHOSEN FOR DESIGN.

Flanders, S.N., et al, Structural use of wood in adverse environments. Edited by R.W. Meyer and R.M. Kellogg. New York, Van Nostrand Reinhold Co., 1982, p.385-397.

Tobiasson, W.

37-1030

PORTABLE SHELTERS, WOODEN STRUCTURES, MILITARY TRANSPORTATION, COLD WEATHER TESTS, LOADS (FORCES), AIRPLANES, DESIGN, CONSTRUCTION MATERIALS.

Construction of a prototype shelter particularly suited to accommodate a party of four to six in the extreme cold at remote locations has been completed recently. To facilitate transportation, the shelter doubles as an ISO shipping container and self-loads onto military aircraft. These modes endure severe loads. Wood was chosen as a suitable material for use in the cold. The requirement for light weight necessitated that the wood be used close to its strength limits. The limits for bonding wood and employing composite panels were tested and compared with calculated values. Urethane-based adhesive was chosen to bound high-density overlay (HDO) plywood and redwood sections together. Fiberglass-reinforced plastic (FRP) mat was chosen as a material to strengthen webs against shear.

MP 1559

SYNOPTIC WEATHER CONDITIONS DURING SELECTED SNOWFALL EVENTS BETWEEN DECEMBER 1981 AND FEBRUARY 1982.

Bilello, M.A., *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* May 1982, 82-8, p.9-42.

37-1095

SYNOPTIC METEOROLOGY, SNOWFALL, SNOWSTORMS, WEATHER OBSERVATIONS, STATISTICAL ANALYSIS.

MP 1560

METEOROLOGY.

Bates, R.E., *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* May 1982, 82-8, p.43-180.

37-1096

METEOROLOGICAL DATA, SNOWSTORMS, SNOWFALL, STATISTICAL ANALYSIS, SNOW DEPTH, SNOW WATER EQUIVALENT, SNOW TEMPERATURE.

MP 1561

SNOW CRYSTAL HABIT.

Koh, G., et al, *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* May 1982, 82-8, p.181-216, 5 refs.

O'Brien, H.W.

37-1097

SNOWFLAKES, SNOW CRYSTAL STRUCTURE, SNOW OPTICS, SNOWFALL, PARTICLE SIZE DISTRIBUTION, SPECTRA.

MP 1562

AIRBORNE SNOW AND FOG DISTRIBUTIONS.

Berger, R.H., *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* May 1982, 82-8, p.217-223.

37-1098

SNOWFLAKES, SNOWSTORMS, SNOW CRYSTAL STRUCTURE, FOG, UNFROZEN WATER CONTENT, PARTICLE SIZE DISTRIBUTION, CLASSIFICATIONS.

MP 1563

MEASUREMENTS OF AIRBORNE-SNOW CONCENTRATION.

Lacombe, J., *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* May 1982, 82-8, p.225-281, 2 refs.

37-1099

SNOWFALL, SNOWFLAKES, COMPUTER APPLICATIONS, MEASUREMENT.

MP 1564

SNOW COVER CHARACTERIZATION.

O'Brien, H.W., et al, *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* May 1982, 82-8, p.559-577, 7 refs.

Bates, R.E.

37-1106

SNOW COVER, SNOWFALL, SNOW DEPTH, SNOW HARDNESS, SNOW DENSITY, SNOW TEMPERATURE, UNFROZEN WATER CONTENT.

MP 1565

PERMEABILITY OF A MELTING SNOW COVER.

Colbeck, S.C., et al, *Water resources research,* Aug. 1982, 18(4), p.904-908, 16 refs.

Anderson, E.A.

37-1226

SNOW MELTING, SNOW PERMEABILITY, MELTWATER, SNOW DENSITY, SNOW COVER, SATURATION, RUNOFF.

Data from snow lysimeters in California and Vermont are used to find the saturated permeability of a melting snow cover in the range of 10-40x10/(10 sq m) depending on snow density. The unsaturated permeability increases as about the third power of liquid saturation. The gravity flow theory is shown to be an accurate representation of meltwater drainage from snow covers in two diverse areas even though the snow covers are treated as homogeneous units. The variation of saturated permeability with snow density occurs about as predicted by Shimizu's formula for dry snow, although ice layers decrease the permeability somewhat.

MP 1566

PHYSICAL ASPECTS OF WATER FLOW THROUGH SNOW.

Colbeck, S.C., Advances in hydroscience. Volume 11. Edited by V.T. Chow., New York, Academic Press, 1978, p.165-206, Refs. p.204-206.

37-1280

WET SNOW, SNOW HYDROLOGY, WATER FLOW, SNOW PERMEABILITY, SNOW COVER STRUCTURE, POROUS MATERIALS, THERMODYNAMICS, RAIN, MATHEMATICAL MODELS.

MP 1567

SENSITIVITY OF A FROST HEAVE MODEL TO THE METHOD OF NUMERICAL SIMULATION.

Hromadka, T.V., II, et al, *Cold regions science and technology,* Aug. 1982, 6(1), p.1-10, 10 refs.

Guymon, G.L., Berg, R.L.

37-1329

FROST HEAVE, SOIL FREEZING, HEAT TRANSFER, MATHEMATICAL MODELS, ANALYSIS (MATHEMATICS).

A unifying numerical method is developed for solution of frost heave in a vertical freezing column of soil. Within one general computer code a single unifying parameter can be preselected to employ the commonly used Galerkin finite elements, subdomain weighted residual, or finite difference methods as well as several other methods developed from the Alternation Theorem. Comparing results from the various numerical techniques in the computation of frost heave to measured frost heave in a laboratory column indicates there is little advantage of the numerical technique over another.

MP 1568

DETERMINATION OF THE FLEXURAL STRENGTH AND ELASTIC MODULUS OF ICE FROM *IN SITU* CANTILEVER-BEAM TESTS.

Tatinclaux, J.C., et al, *Cold regions science and technology,* Aug. 1982, 6(1), p.37-47, 4 refs.

Hirayama, K.

37-1333

ICE COVER STRENGTH, FLEXURAL STRENGTH, ICE ELASTICITY, ICE PHYSICS, LOADS (FORCES), ICE SHEETS, ANALYSIS (MATHEMATICS).

From the theory of cantilever beams on an elastic foundation, it is shown that the strength index and modulus index of ice can be determined from measurements of either the failure load or the tip deflection, or both, of in situ cantilever beams tested over a wide enough range of ratio of beam length to beam thickness. Four methods are proposed, two of which do not require the measurement of beam deflection during beam loading, an often difficult task to perform with sufficient reliability, especially in the field.

MP 1569

ICE DISTRIBUTION AND WINTER SURFACE CIRCULATION PATTERNS, KACHEMAK BAY, ALASKA.

Gatto, L.W., *Remote sensing of environment,* 1982, No.12, p.421-435, For more detailed article see 36-2432. 14 refs.

37-1440

SEA ICE DISTRIBUTION, ICE CONDITIONS, OCEAN CURRENTS, SUSPENDED SEDIMENTS, OCEANOGRAPHY, REMOTE SENSING, UNITED STATES—ALASKA—KACHEMAK BAY.

MP 1570

DETERMINING THE CHARACTERISTIC LENGTH OF MODEL ICE SHEETS.

Sodhi, D.S., et al, *Cold regions science and technology,* Nov. 1982, 6(2), p.99-104, 6 refs.

Kato, K., Haynes, F.D., Hirayama, K.

37-1582

FLOATING ICE, ICE STRENGTH, ICE SHEETS, LOADS (FORCES), FLEXURAL STRENGTH, ICE ELASTICITY, STRESSES, ICE CREEP, ICE MODELS.

For determining the characteristic length of a floating ice sheet, a vertical load is applied to the ice sheet either by placing dead weights in discrete increments or with a screw drive apparatus in series with a load cell, and the deflection of the ice sheet is monitored at the point of loading or near it. For a model ice sheet exhibiting creep behavior, the experimental results with the screw apparatus show that the slope of the load-deflection curve decreases as the load increases, and one is not able to choose a unique value of the slope for the computation of characteristic length. This is attributed to relaxation of stress in ice.

MP 1571

FIRN QUAKE (A RARE AND POORLY EXPLAINED PHENOMENON).

DenHartog, S.L., *Cold regions science and technology,* Nov. 1982, 6(2), p.173-174, 7 refs.

37-1589

FIRN, SNOW DEFORMATION, SNOW SURFACE, CRACKS.

A firn quake is a sudden collapse of a snow surface with a noise of increasing intensity. This description applies to firn quakes on large ice sheets, shuch as cover Greenland and Antarctica. There are many unknowns about firn quake phenomena.

MP 1572

ELECTRICAL PROPERTIES OF FROZEN GROUND AT VHF NEAR POINT BARROW, ALASKA.

Arcone, S.A., et al, *IEEE transactions on geoscience and remote sensing,* Oct. 1982, GE-20(4), p.485-492, 16 refs.

Delaney, A.J.

37-1685

FROZEN GROUND PHYSICS, ELECTRICAL PROPERTIES, RADIO WAVES, GROUND ICE, MODELS, ORGANIC SOILS, SOIL WATER.

Electrical properties of frozen ground were measured using radio frequency interferometry (RFI) in the very high frequency (VHF) radiowave band. Ice-rich organic silts and sandy gravel of variable ice content were investigated during early April of both 1979 and 1980. Frequencies between 10 and 150 MHz were used but best results were obtained at VHF between 10 and 100 MHz.

MP 1573

STATE OF THE ART OF SHIP MODEL TESTING IN ICE.

Vance, G.P., American Towing Tank Conference, General Meeting, 19th, Ann Arbor, Michigan, July 9-11, 1980. Proceedings, Vol.2. Edited by S.B. Cohen, Ann Arbor, Science Publishers, [1981], p.693-706, 5 refs.

37-1692

ICE LOADS, ICE PRESSURE, SHIPS, STRENGTH, MODELS, LOADS (FORCES), TESTS, SNOW COVER EFFECT.

MP 1574

UNIFORM SNOW LOADS ON STRUCTURES.

O'Rourke, M.J., et al, *American Society of Civil Engineers. Structural Division. Journal,* Dec. 1982, 108(ST12), p.2781-2798, 12 refs.

Redfield, R., Von Bradsky, P.

37-1756

SNOW LOADS, ROOFS, STRUCTURES, SLOPE ORIENTATION, EXPOSURE, SNOW ACCUMULATION, THERMAL EFFECTS, SURFACE PROPERTIES.

Data on ground and roof snow loads for 199 structures are analyzed. Relationship between ground-to-roof conversion factor for uniform roof loads and parameters such as roof slope, exposure and thermal characteristics are investigated. The conversion factor was found to be most strongly influenced by exposure.

MP 1575

APPLICATION OF HEC-2 FOR ICE-COVERED WATERWAYS.

Calkins, D.J., et al, *American Society of Civil Engineers. Technical Councils of ASCE. Journal,* Nov. 1982, 108(TC2), p.241-248, 5 refs.

Hayes, R., Daly, S.F., Montalvo, A.

37-2018

CHANNELS (WATERWAYS), WATER FLOW, ICE COVER EFFECT, FLOATING ICE, FLOW RATE, RIVER FLOW, COMPUTER PROGRAMS.

HEC-2, the widely known open channel flow water surface profile computer program developed by the U.S. Army Corps of Engineers' Hydrologic Engineering Center, has been recently updated for the U.S. Army Cold Regions Research and Engineering Laboratory to account for the presence of a floating ice cover. It has been shown by many writers that at uniform flow the normal flow depth can be increased by as much as 30% by a floating ice cover. HEC-2 with the ice cover option will allow the Corps of Engineers and other users of the program to evaluate effectively the effect of an ice cover on the flow depth, flow velocity, unit discharge, etc., in a river system. This paper presents an overview of the modifications to the uniform flow equation, the required input data, and an analysis.

MP 1576

SOURCE MECHANISM OF VOLCANIC TREMOR.

Ferrick, M.G., et al, *Journal of geophysical research*, Oct. 10, 1982, 87(B10), p.8675-8683, 27 refs.

Qamar, A., St. Lawrence, W.F.

37-2111

EARTHQUAKES, VOLCANOES, FLUID DYNAMICS, *FLUID FLOW*, UNITED STATES—*OREGON*—*HOOD*, MOUNT.

Low-frequency (<10 Hz) volcanic earthquakes originate at a wide range of depths and occur before, during, and after magmatic eruptions. The characteristics of these earthquakes suggest that they are not typical tectonic events. Physically analogous processes occur in hydraulic fracturing of rock formations, low-frequency icequakes in temperate glaciers, and autoresonance in hydroelectric power stations. We propose that unsteady fluid flow in volcanic conduits is the common source mechanism of low-frequency volcanic earthquakes (tremor). The fluid dynamic source mechanism explains low-frequency earthquakes of arbitrary duration, magnitude, and depth of origin, as unsteady flow is independent of physical properties of the fluid and conduit. Fluid transients occur in both low-viscosity gases and high-viscosity liquids. A fluid transient analysis can be formulated as generally as is warranted by knowledge of the composition and physical properties of the fluid, material properties, geometry and roughness of the conduit, and boundary conditions. (Auth. mod.)

MP 1577

COMMENT ON 'WATER DRAG COEFFICIENT OF FIRST-YEAR SEA ICE' BY M.P. LANGLEBEN.

Andreas, E.L., et al, *Journal of geophysical research*, Jan. 20, 1983, 88(C1), p.779-782, Includes the comment by Andreas and the reply by Langleben. For the article being discussed see 36-2494. 11 refs.

Langleben, M.P.

37-2110

SEA ICE, SURFACE ROUGHNESS, FRICTION, ANALYSIS (MATHEMATICS).

MP 1578

MICROBIOLOGICAL AEROSOLS FROM A FIELD-SOURCE WASTEWATER IRRIGATION SYSTEM.

Bausum, H.T., et al, *Water Pollution Control Federation. Journal*, Jan. 1983, 55(1), p.65-75, 20 refs.

Schaub, S.A., Bates, R.E., McKim, H.L., Schumacher, P.W., Brockett, B.E.

37-2176

WASTE TREATMENT, WATER TREATMENT, BACTERIA, AEROSOLS, IRRIGATION, MICROBIOLOGY.

MP 1579

ON MODELING SEASONAL AND INTERANNUAL FLUCTUATIONS OF ARCTIC SEA ICE.

Hibler, W.D., III, et al, *Journal of physical oceanography*, Dec. 1982, 12(12), p.1514-1523, 20 refs.

Walsh, J.E.

37-2362

SEA ICE DISTRIBUTION, PERIODIC VARIATIONS, ICE MODELS.

Some results from a series of three-year aperiodic simulations of the Northern Hemisphere sea ice cover are reported. The simulations employ the dynamic-thermodynamic sea ice model developed by Hibler (1979) and use a one-day timestep on a 35 x 31 grid with a resolution of 222 km. Atmospheric data from the years 1973-75 are used to drive the simulations. The simulations yield a seasonal cycle with excessive amounts of ice in the North Atlantic during winter and with somewhat excessive amounts of open water in the central Arctic during summer. Despite the seasonal bias, the simulated and observed interannual fluctuations are similar in magnitude and are positively correlated. The correlations with observed data are noticeably smaller when dynamical processes are omitted from the model. The simulated outflow of ice through the Greenland-Spitsbergen passage undergoes large fluctuations both seasonally and on an interannual basis. The outflow correlates highly with the simulated fluctuations of ice coverage in the North Atlantic sector and positively with the observed fluctuations of ice coverage in the same sector.

MP 1580

ADHESION OF ICE TO POLYMERS AND OTHER SURFACES.

Itagaki, K., Physicochemical aspects of polymer surfaces, Vol.1. Edited by K.L. Mittal, Plenum Publishing Corporation, Mar. 1983, p.241-252, 15 refs.

37-2274

ICE ADHESION, ICE SOLID INTERFACE, ICE STRENGTH, POLYMERS, PROTECTIVE COATINGS.

A set of simple experiments indicated that water drops can penetrate through a grease layer and make "real" contact with the substrate, then spread over the surface, depending on the surface energy of the substrate, increasing the "real" contact area. Furthermore the ice/substrate bond is stronger than ice itself. The complex problem of ice adhesion may be explainable by combination of these findings in that the "real" contact area multiplied by the strength of ice within the area constitute the apparent adhesive strength. *Conceivable effects of various factors* are discussed.

MP 1581

PROCEEDINGS.

International Offshore Mechanics and Arctic Engineering Symposium, 2nd, Houston, Texas, Jan. 30-Feb. 3, 1983, New York, N.Y., American Society of Mechanical Engineers, 1983, 813p., Refs. passim. For selected papers see 37-2389 through 37-2406.

Chung, J.S., ed, Lunardini, V.J., ed.

37-2388

OFFSHORE DRILLING, OFFSHORE STRUCTURES, ICE CONDITIONS, DRIFT, PERMAFROST, ARTIFICIAL ISLANDS, ICE LOADS, COMPUTER APPLICATIONS, ICE PHYSICS, SEA ICE.

MP 1582

EFFECT OF STRESS APPLICATION RATE ON THE CREEP BEHAVIOR OF POLYCRYSTALLINE ICE.

Cole, D.M., International Offshore Mechanics and Arctic Engineering Symposium, 2nd, Houston, Texas, Jan. 30-Feb. 3, 1983. Proceedings. Edited by J.S. Chung and V.J. Lunardini, New York, N.Y., American Society of Mechanical Engineers, 1983, p.614-621, 14 refs.

37-2392

ICE CREEP, ICE CRYSTAL STRUCTURE, ICE ACOUSTICS, STRESS STRAIN DIAGRAMS, MICROSTRUCTURE, ICE *CRACKS*, *RHEOLOGY*, CRACKING (FRACTURING), TIME FACTOR.

This work *examines* the effect of the rate of stress application on the creep behavior of polycrystalline ice. Stress rates from 1/1000 to 1.84 MPa/s were used to achieve a creep stress of 3.6 MPa at test temperatures of -5 to -10C. The treatment emphasizes the effect of stress application rate on primary creep behavior and the accompanying microfracturing activity. Acoustic emission measurements taken in all tests indicate the onset and rate peak of the microfracturing activity.

MP 1583

FREEZING OF SEMI-INFINITE MEDIUM WITH INITIAL TEMPERATURE GRADIENT.

Lunardini, V.J., International Offshore Mechanics and Arctic Engineering Symposium, 2nd, Houston, Texas, Jan. 30-Feb. 3, 1983. Proceedings. Edited by J.S. Chung and V.J. Lunardini, New York, N.Y., American Society of Mechanical Engineers, 1983, p.649-652, 11 refs.

37-2397

SOIL FREEZING, HEAT TRANSFER, TEMPERATURE GRADIENTS, STEFAN PROBLEM, GEOTHERMY, HEAT BALANCE, ANALYSIS (MATHEMATICS), THERMAL CONDUCTIVITY.

Exact solutions to problems of conductive heat transfer with solidification are rare due to the non-linearity of the equations. The heat balance integral technique is used to obtain an approximate solution to the freezing of a semi-infinite region with a linear, initial temperature distribution. The results indicate that the constant temperature Neumann solution is acceptable for soil systems with a geothermal gradient unless extremely long freezing times are considered. The heat balance integral will yield good solutions, with simple numerical work, even for non-constant initial temperatures.

MP 1584

SIMPLE FIXED MESH FINITE ELEMENT SOLUTION OF TWO-DIMENSIONAL PHASE CHANGE PROBLEMS.

O'Neill, K., International Offshore Mechanics and Arctic Engineering Symposium, 2nd, Houston, Texas, Jan. 30-Feb. 3, 1983. Proceedings. Edited by J.S. Chung and V.J. Lunardini, New York, N.Y., American Society of Mechanical Engineers, 1983, p.653-658, 24 refs.

37-2398

FREEZE THAW CYCLES, HEAT TRANSFER, PHASE TRANSFORMATIONS, LATENT HEAT, THERMAL CONDUCTIVITY, MATHEMATICAL MODELS, ENTHALPY.

An algorithm has been developed for two-dimensional freezing and thawing problems, which may also be useful for some other phase change problems. *It is designed* to be implemented simply in standard finite element heat conduction computer codes which use linear interpolation within elements. Substances with discrete phase change temperatures such as water suffer a step change in enthalpy across a phase change isotherm, and hence feature a theoretically infinite heat capacity there. The algorithm handles this potentially troublesome phenomenon in a natural way through usual finite element procedures, using simple closed form expressions.

MP 1585

ICE DYNAMICS IN THE CANADIAN ARCHIPELAGO AND ADJACENT ARCTIC BASIN AS DETERMINED BY ERTS-1 OBSERVATIONS.

Ramseier, R.O., et al, Canada's continental margins and *offshore petroleum exploration*. Edited by C.J. Yorath, E.R. Parker and D.J. Glass, Calgary, Alberta, Canadian Society of Petroleum Geologists, May 1975, p.853-877, 13 refs.

Campbell, W.J., Weeks, W.F., Drapier-Arsenault, L., Wilson, K.L.

37-2463

ICE MECHANICS, SEA ICE DISTRIBUTION, DRIFT, ICE CONDITIONS, REMOTE SENSING, ICE BREAKUP, FREEZEUP, ERTS IMAGERY.

ERTS-1 "Quicklook" imagery for the period March to November 1973 has been utilized to study sea ice in the Canadian archipelago and in the adjacent Arctic basin. The imagery, which provides extensive coverage of the area of interest, contains detailed information on variations in sea ice dynamics and ice morphology on a time scale ranging from several days to seasons. Because of the sidelap of the ERTS-1 orbits over the study area, recognizable ice floes could be tracked on repetitive daily images for time periods as long as 6 days. Information on ice drift velocity, compactness, floe size, fast ice and ice melt patterns, and dates of breakup and freezeup were obtained.

MP 1586

SIMULATION OF THE ENRICHMENT OF ATMOSPHERIC POLLUTANTS IN SNOW COVER RUNOFF.

Colbeck, S.C., *Eastern Snow Conference. Proceedings*, 1981, 38th, p.1-10, 16 refs. For another version see 36-1887.

37-2768

SNOW COMPOSITION, SNOW IMPURITIES, AIR POLLUTION, RUNOFF, MELTWATER, EN*VIRONMENTAL IMPACT*, *SNOW CRYSTAL* NUCLEI, EXPERIMENTATION, SNOW COVER.

The soluble impurities contained in a snow cover can be concentrated as much as five fold in the first fractions of snow melt runoff. In addition, daily impurity surges are possible. Melt-freeze cycles *concentrate* the *impurities* in the lower portion of the snow cover hence prepare the impurities for rapid removal. Environmental damage can occur due to the concentration and rapid release of atmospheric pollutants from the snow, especially in areas of "acid precipitation." The enrichment of the soluble impurities is explained and the results of laboratory experiments are given.

MP 1587

STRESS/STRAIN/TIME RELATIONS FOR ICE UNDER UNIAXIAL COMPRESSION.

Mellor, M., et al, *Cold regions science and technology*, Feb. 1983, 6(3), p.207-230, 9 refs.

Cole, D.M.

37-2878

ICE CREEP, ICE MECHANICS, STRESS STRAIN DIAGRAMS, LOADS (FORCES), COMPRESSIVE PROPERTIES, STATIC LOADS, TIME FACTOR, ANALYSIS (MATHEMATICS), TESTS, RHEOLOGY.

Results of mechanical tests involving uniaxial compression of isotropic ice at -5C were analysed and interpreted. Constant load (CL) creep tests were made *for applied* stresses in the range 0.8 to 3.8 MPa, and "strength" tests under constant displacement rate (CD) were made for applied strain rates in the range 1/10,000,000 to 1/1,000 1/s. Results from CL tests and CD tests *corresponded closely*, giving much the same information about failure strains, strength, creep rates, time to failure, stress/strain-rate relations, etc.

MP 1588

PHYSICS OF MATHEMATICAL FROST HEAVE MODELS: A REVIEW.

O'Neill, K., *Cold regions science and technology*, Feb. 1983, 6(3), p.275-291, Refs. p.289-291.

37-2883

FROST HEAVE, FROZEN GROUND PHYSICS, THERMODYNAMICS, PHYSICAL PROPERTIES, STRESSES, MATHEMATICAL MODELS, GROUND ICE.

This paper is concerned with the physical and thermodynamical bases of frost heave modeling. An attempt is made to isolate and illuminate issues which all such models must address, at least by implication. Although numerous relevant publications are surveyed, emphasis is less on an enumeration of items in the literature, and more on the concepts themselves, and on their alternative mathematical expressions, approximations, and manners of *applications*. Ultimately a selection of specific mathematical models is discussed, in light of the points raised in the general discussion.

MP 1589
PRELIMINARY INVESTIGATION OF THE ACOUSTIC EMISSION AND DEFORMATION RESPONSE OF FINITE ICE PLATES.
Xirouchakis, P.C., et al, *National Research Council, Canada. Associate Committee on Geotechnical Research. Technical memorandum,* Jan. 1982, No.134, p.129-139, 10 refs.
St. Lawrence, W.F.
37-2905
ICE ACOUSTICS, ICE DEFORMATION, LOADS (FORCES), FRACTURING, PLATES, ICE CRACKS, ELASTIC WAVES, VISCOELASTICITY, GRAIN SIZE, EXPERIMENTATION.

A procedure is described for monitoring the microfracturing activity in ice plates subjected to constant loads. Sample time records of fresh water ice plate deflections as well as corresponding total acoustic emission activities are presented. The linear elastic as well as visco-elastic response for a simple supported rectangular ice plate is obtained. Suggested future work using the above procedure is discussed.

MP 1590
MODELING PRESSURE RIDGE BUILDUP ON THE GEOPHYSICAL SCALE.
Hibler, W.D., III, *National Research Council, Canada. Associate Committee on Geotechnical Research. Technical memorandum,* Jan. 1982, No.134, p.141-155, 8 refs.
37-2906
PRESSURE RIDGES, ICE COVER THICKNESS, ICE PILEUP, ICE STRENGTH, ICE PHYSICS, SEA ICE DISTRIBUTION, SURFACE ROUGHNESS, STRESSES, ICE MODELS, PACK ICE.

In large scale sea ice models ridging is modeled by redistributing thin ice into thicker categories. The way in which this redistribution is carried out can significantly affect the geophysical stresses in pack ice. This paper compares ice strength characteristics of several different redistributors and discusses the relationship of these redistributors with observed ridge morphological data. In addition, simulated Arctic Basin ridge buildup results using one of these redistributors are presented and compared to roughness observations reported in the literature.

MP 1591
FIELD METHODS AND PRELIMINARY RESULTS FROM SUBSEA PERMAFROST INVESTIGATIONS IN THE BEAUFORT SEA, ALASKA.
Sellmann, P.V., et al, *National Research Council, Canada. Associate Committee on Geotechnical Research. Technical memorandum,* June 1979, No.124, p.207-213, 6 refs.
Chamberlain, E.J., Blouin, S.E., Iskandar, I.K., Lewellen, R.I.
37-2962
SUBSEA PERMAFROST, PERMAFROST THERMAL PROPERTIES, PENETRATION TESTS, GEOPHYSICAL SURVEYS, TEMPERATURE GRADIENTS, GROUND WATER, WATER CHEMISTRY, ENGINEERING, BEAUFORT SEA.

MP 1592
NUMERICAL SIMULATION OF THE WEDDELL SEA PACK ICE.
Hibler, W.D., III, et al, *Journal of geophysical research,* Mar. 30, 1983, 88(C5), p.2873-2887, 29 refs.
Ackley, S.F.
37-2983
SEA ICE, ICE MECHANICS, DRIFT, ICE MODELS, ICE COVER THICKNESS, ANTARCTICA—WEDDELL SEA.

The simulations employ a dynamic thermodynamic model developed in 1979 and use a 1-day time step on an 18 x 15 grid with a resolution of 122 km. Daily atmospheric data from 1979 are used to drive the simulations, which yield a seasonal cycle of ice with maximum extents close to that observed. The advance of the ice is primarily thermodynamic in nature, while the rapid decay depends critically on the presence of both leads and lateral ice advection. The average fraction of open water is substantial and varies from 10% in September to 35% in March. These values are in general agreement with estimates from satellite microwave data. Mean ice thicknesses are consistent with observations and vary from about 3 m in the perennial ice in the western Weddell to 1 m in first-year ice in the eastern Weddell. Simulated ice drift results yield mean drift rates of about 5 km/day, in good agreement with buoy drift observations with slightly inadequate northward transport in the western Weddell. Near the ice edge the drift rates are relatively insensitive to the ice strength. Near the coast, however, lower strengths are found to yield a decrease in northward drift rates. (Auth. mod.)

MP 1593
APPROXIMATE PHASE CHANGE SOLUTIONS FOR INSULATED BURIED CYLINDERS.
Lunardini, V.J., *Journal of heat transfer,* Feb. 1983, 105(1), p.25-32, 14 refs.
37-3169
FREEZE THAW CYCLES, UNDERGROUND PIPELINES, HEAT TRANSFER, PIPES (TUBES), PHASE TRANSFORMATIONS, THERMAL PROPERTIES, THERMAL INSULATION, TEMPERATURE EFFECTS, ANALYSIS (MATHEMATICS).

The conduction problem for cylinders embedded in a medium with variable thermal properties cannot be solved exactly if phase change occurs. New, approximate solutions have been found using the quasi-steady method. These solutions consider heat flow from the entire pipe surface, rather than from a single point, as has been assumed in the past. The temperature field, phase change location, and pipe surface heat transfer can be evaluated using graphs presented for parametric range of temperature, thermal properties, burial depth, and insulation thickness.

MP 1594
COMPARISON OF UNFROZEN WATER CONTENTS MEASURED BY DSC AND NMR.
Oliphant, J.L., et al, International Symposium on Ground Freezing, 3rd, Hanover, N.H., June 22-24, 1982. Proceedings, ₍1982₎, p.115-121, 15 refs.
Tice, A.R.
37-3069
UNFROZEN WATER CONTENT, FROZEN GROUND STRENGTH, SPECIFIC HEAT, SOIL FREEZING, TEMPERATURE EFFECTS, CALORIMETRY.

Unfrozen water contents of various sands, silts and clay under partially frozen conditions have been measured using Nuclear Magnetic Resonance (NMR). Apparent specific heats for many of these soils have been measured as a function of temperature using Differential Scanning Calorimetry (DSC). Unfrozen water contents have been calculated from the DSC data and compared with those directly measured with NMR.

MP 1595
FREEZING OF SOIL WITH SURFACE CONVECTION.
Lunardini, V.J., International Symposium on Ground Freezing, 3rd, Hanover, N.H., June 22-24, 1982. Proceedings, ₍1982₎, p.205-212, 17 refs.
37-3079
PERMAFROST PHYSICS, PHASE TRANSFORMATIONS, FROZEN GROUND STRENGTH, SOIL FREEZING, SURFACE PROPERTIES, HEAT TRANSFER, ARTIFICIAL FREEZING, FROZEN GROUND TEMPERATURE, LATENT HEAT, SURFACE TEMPERATURE, TIME FACTOR, CONVECTION, ANALYSIS (MATHEMATICS), STORAGE.

Phase change phenomena arise frequently in applications such as thermal design in permafrost regions, thermal storage of latent heat for solar systems, and the heat treatment of metals. These are problems of conductive heat transfer with solidification phase change. Exact solutions are sought for geometries and boundary conditions which are simple and yet representative of practical systems.

MP 1596
INITIAL STAGE OF THE FORMATION OF SOIL-LADEN ICE LENSES.
Takagi, S., International Symposium on Ground Freezing, 3rd, Hanover, N.H., June 22-24, 1982. Proceedings, ₍1982₎, p.223-232, 8 refs.
37-3081
GROUND ICE, FROZEN GROUND STRENGTH, ICE LENSES, SOIL FREEZING, ICE FORMATION, ARTIFICIAL FREEZING, FROST HEAVE, THERMAL CONDUCTIVITY, STEFAN PROBLEM, ANALYSIS (MATHEMATICS), FROST ACTION, SOIL WATER.

O'Neill and Miller's equations for frost heave in saturated soil/water system, presented in the 2nd I.S.G.F.at Trondheim, reduce to heat conduction equations on introduction of two simplifying assumptions. The reduced equations are solved by use of the recently developed analytical method that can solve the Stefan problem with arbitrary initial and boundary conditions.

MP 1597
FREEZING AND THAWING: HEAT BALANCE INTEGRAL APPROXIMATIONS.
Lunardini, V.J., *Journal of energy resources technology,* Mar. 1983, 105(1), p.30-37, 17 refs.
37-3205
FREEZE THAW CYCLES, PERMAFROST THERMAL PROPERTIES, HEAT BALANCE, STEFAN PROBLEM, SOIL FREEZING, GROUND THAWING, LATENT HEAT, SURFACE PROPERTIES, HEAT TRANSFER, PHASE TRANSFORMATIONS, CONVECTION, ANALYSIS (MATHEMATICS).

The study of conductive heat transfer with phase change—often called the Stefan problem—includes some of the most intractable mathematical areas of heat transfer. Exact solutions are extremely limited and approximate methods are widely used. This paper discusses the heat balance integral approximation using the collocation method. The method is applied to some standard problems of phase change—Neumann's problem—and a new solution is presented for the case of a semi-infinite body with surface convection. Numerical results are given for soil systems and also for materials of interest in latent heat thermal storage.

MP 1598
APPROXIMATE SOLUTION TO CONDUCTION FREEZING WITH DENSITY VARIATION.
Lunardini, V.J., *Journal of energy resources technology,* Mar. 1983, 105(1), p.43-45, 5 refs.
37-3207
HEAT TRANSFER, FREEZE THAW CYCLES, PERMAFROST THERMAL PROPERTIES, DENSITY (MASS/VOLUME), WATER, PHASE TRANSFORMATIONS, LATENT HEAT, ANALYSIS (MATHEMATICS).

MP 1599
DYNAMICS OF NEAR-SHORE ICE.
Kovacs, A., et al, Environmental assessment of the Alaskan continental shelf, Vol.7, Hazards. Principal investigators' annual reports for the year ending March 1981. Boulder, Colorado, Outer Continental Shelf Environmental Assessment Program, ₍1981₎, p.125-135.
Weeks, W.F.
37-3247
SEA ICE DISTRIBUTION, ICE MECHANICS, DRIFT, PRESSURE RIDGES, ICE PILEUP, ICE SCORING.

Research Unit No.88 investigates sea ice and ice induced gouges in the sea floor along the coasts of the Beaufort, Chukchi, and Bering Seas. New results reported during FY81 include further documentation of coastal ice pileup and over-ride events, studies of the block size distributions in first-year pressure ridges, investigations of additional laser profilometer observations on pressure ridges, radar studies of near-shore lakes on the North Slope that may serve as year-round sources of fresh water, and the preparation of a review paper on the physical environment of arctic Alaska as it relates to petroleum exploration and production.

MP 1600
DELINEATION AND ENGINEERING CHARACTERISTICS OF PERMAFROST BENEATH THE BEAUFORT SEA.
Sellmann, P.V., et al, Environmental assessment of the Alaskan continental shelf, Vol.7, Hazards. Principal investigators' annual reports for the year ending March 1981, Boulder, Colorado, Outer Continental Shelf Environmental Assessment Program, ₍1981₎, p.137-156, 4 refs.
Neave, K.G., Chamberlain, E.J., Delaney, A.J.
37-3248
SUBSEA PERMAFROST, PERMAFROST DISTRIBUTION, SEISMIC VELOCITY, ENGINEERING, SEISMIC SURVEYS, NATURAL GAS, BEAUFORT SEA.

Velocity data derived from the study of industry seismic records from lease area No.71 indicate that bonded permafrost is common. Its distribution will likely be as variable as it is to the east near Prudhoe Bay. Bonded permafrost should extend many kilometers offshore of the islands in the eastern part of the lease area.

MP 1601
TRANSPORT OF WATER IN FROZEN SOIL. 2. EFFECTS OF ICE ON THE TRANSPORT OF WATER UNDER ISOTHERMAL CONDITIONS.
Nakano, Y., et al, *Advances in water resources,* Mar. 1983, 6(1), p.15-26, 16 refs.
Tice, A.R., Oliphant, J.L., Jenkins, T.F.
37-3558
SOIL WATER MIGRATION, FROZEN GROUND PHYSICS, GROUND ICE, SOIL FREEZING, WATER TRANSPORT, TEMPERATURE EFFECTS, ANALYSIS (MATHEMATICS).

Effects of ice on the transport of water in frozen soil were investigated under isothermal conditions. Based on the experimental results obtained using a marine-deposited clay at -1.0C, the presence of ice is shown to significantly affect the transport of water under centain circumstances. A theoretical analysis of the experimental results and a discussion of a possible mechanism for water transport in frozen soil are presented.

MP 1602
ICE ENGINEERING.
O'Steen, D.A., *Water spectrum,* Spring 1980, 12(2), p.41-47.
37-3551
DOCKS, ICE LOADS, PILE STRUCTURES, PILE EXTRACTION, ENGINEERING, OFFSHORE STRUCTURES, WATER LEVEL, PIERS, TESTS.

MP 1603

THEORY OF METAMORPHISM OF DRY SNOW.

Colbeck, S.C., *Journal of geophysical research,* June 20, 1983, 88(C9), p.5475-5482, 16 refs.
37-3571

METAMORPHISM (SNOW), SNOW CRYSTAL GROWTH, TEMPERATURE GRADIENTS, VAPOR DIFFUSION, ICE CRYSTAL GROWTH, TEMPERATURE EFFECTS, ANALYSIS (MATHEMATICS), THEORIES.

The growth of ice particles in dry seasonal snow is caused by vapor diffusion among particles due to temperature gradients imposed on the snow cover. The diffusion is calculated by using the potential field solutions for electrostatically charged particles. The stereography of snow is represented by using a log-normal distribution function for a geometric enhancement factor defined here. Reasonable crystal growth rates and supersaturations are found.

MP 1604

RECENT ADVANCES IN UNDERSTANDING THE STRUCTURE, PROPERTIES, AND BEHAVIOR OF SEA ICE IN THE COASTAL ZONES OF THE POLAR OCEANS.

Weeks, W.F., et al, International Conference on Port and Ocean Engineering under Arctic conditions, 7th, Helsinki, Finland, April 5-9, 1983. Proceedings, Espoo, Finland, Valtion teknillinen tutkimuskeskus, 1983, p.25-41, 32 refs.
Ackley, S.F.
37-3714

SEA ICE, ICE STRENGTH, PRESSURE RIDGES, ICE CRYSTAL STRUCTURE, ICE WATER INTERFACE, FRAZIL ICE, ICE COVER THICKNESS, ICE FLOES, COMPRESSIVE PROPERTIES, STRAINS, GAS INCLUSIONS, BRINES, WEDDELL SEA.

A review is given of recent field and laboratory studies that have 1) revealed vast areas of first-year sea ice that show strong directional c-axis alignments in the horizontal plane with the alignment directed parallel to the current direction at the ice-water interface at the time the ice formed. 2) Discovered unexpected large amounts of frazil ice in the Weddell Sea pack with the largest amounts of frazil occurring in the thickest floes. 3) Determined the strength of multiyear pressure ridges to be comparable to that of first-year sea ice in the hard-fail direction. 4) Developed a rapid method of determining the relative volume of gas in sea ice.

MP 1605

PROTECTION OF OFFSHORE ARCTIC STRUCTURES BY EXPLOSIVES.

Mellor, M., International Conference on Port and Ocean Engineering under Arctic conditions, 7th, Helsinki, Finland, April 5-9, 1983. Proceedings, Espoo, Finland, Valtion teknillinen tutkimuskeskus, 1983, p.310-322, 12 refs.
37-3740

ICE BLASTING, OFFSHORE STRUCTURES, ICE LOADS, ICE BREAKING, PROTECTION, ICE COVER THICKNESS, IMPACT STRENGTH, ICE MECHANICS, FLOATING STRUCTURES, ENVIRONMENTAL PROTECTION, DESIGN.

New design curves for ice blasting relate crater radius with charge weight, charge depth, and ice thickness. Single-charge data can be used to design charge patterns for breaking ice in long channels or over broad areas. When charges are optimized to give maximum energetic efficiency, the specific energy is comparable to that for an ice-breaking ship, and significantly lower than the best attainable specific energy for ice-cutting machines. Shock attenuation curves for underwater explosions permit the calculation of safe distances for structures, fish and divers.

MP 1606

ICE FORCES ON MODEL MARINE STRUCTURES.

Haynes, F.D., et al, International Conference on Port and Ocean Engineering under Arctic conditions, 7th, Helsinki, Finland, April 5-9, 1983. Proceedings, Espoo, Finland, Valtion teknillinen tutkimuskeskus, 1983, p.778-787, 7 refs.
Sodhi, D.S.
37-3776

ICE PRESSURE, OFFSHORE STRUCTURES, ICE SOLID INTERFACE, FLEXURAL STRENGTH, ICE COVER THICKNESS, ICE COVER STRENGTH, ICE ELASTICITY, VELOCITY, EXPERIMENTATION.

Small-scale laboratory experiments were conducted on model marine structures in the CRREL test basin. The experiments were performed by pushing model ice sheets against structures and monitoring the ice forces during the ice-structure interaction. The parameters, varied during the test program, were the geometry of the marine structure and the velocity, thickness, and flexural strength of the ice. The results are presented in the form of ice forces on sloping and vertical structures with different geometries.

MP 1607

DYNAMIC BUCKLING OF FLOATING ICE SHEETS.

Sodhi, D.S., International Conference on Port and Ocean Engineering under Arctic conditions, 7th, Helsinki, Finland, April 5-9, 1983. Proceedings, Espoo, Finland, Valtion teknillinen tutkimuskeskus, 1983, p.822-833, 6 refs.
37-3780

FLOATING ICE, ICE PRESSURE, ICE LOADS, DYNAMIC LOADS, ICE ADHESION, ICE SHEETS, VELOCITY.

Experimental and analytical studies have been conducted to investigate the effect of ice velocity on the buckling loads of floating ice sheets. An analysis of dynamic buckling of a floating ice beam has been conducted for the case when one end of the beam moves at a constant velocity suddenly from rest. Good agreement has been obtained between the results of analytical and experimental studies on the dynamic buckling of floating ice beams.

MP 1608

OBSERVATIONS OF PACK ICE PROPERTIES IN THE WEDDELL SEA.

Ackley, S.F., et al, *Antarctic journal of the United States,* 1982, 17(5), p.105-106, 4 refs.
Smith, S.J., Clarke, D.B.
37-3962

PACK ICE, ICE CONDITIONS, SEA ICE DISTRIBUTION, WEDDELL SEA.

Observations of pack ice in the Weddell Sea during the Weddell Polynya expedition (WEPOLEX-81) culminated in a daily map of ice conditions and a narrative observation log. The narrative log contains information on ice concentration, ridging, amounts of thin ice and open water, and unusual ice features. On the basis of observations, the pack ice zone has been divided into three regions: ice edge region (within 0 to 60 naut. mi. of the northern limit of pack ice); ice edge-pack ice transition zone (within 60 to 160 naut. mi. of the outer limit of pack ice); and deep pack (at distances greater than 160 naut. mi. from the outer limit). In most satellite microwave images the ice edge-pack ice transition zone appears as an area of lesser concentration. Observations did not confirm this. Also unexpected was the observation that noticeable swell propagation occurred at great distances from the outer pack limit.

MP 1609

PHYSICAL, CHEMICAL AND BIOLOGICAL PROPERTIES OF WINTER SEA ICE IN THE WEDDELL SEA.

Clarke, D.B., et al, *Antarctic journal of the United States,* 1982, 17(5), p.107-109, 11 refs.
Ackley, S.F.
37-3963

SEA ICE, ICE COMPOSITION, ICE STRUCTURE, ALGAE, WEDDELL SEA.

Twenty of 27 ice cores and 13 surface ice samples taken between 59 deg 21 min S and 62 deg S have been analyzed for ice structure, salinity, nutrients, fluorescence, chlorophyll a, phaeo-pigment, diatom species enumeration, and bacteria. The primary physical feature is the dominance of frazil ice structure as opposed to congelation ice. The salinity range is 2.4 to 13.7% with the higher salinities within the upper 15 cm. Chemical analysis of nutrients in the cores indicates that they do not follow a dilution curve. Silicate, phosphate, and nitrate are found in higher concentrations in the adjacent surface than in the ice cores. Nitrite levels, however, are two to five times higher in the surface layer of the ice cores than in the adjacent surface water. Chlorophyll a followed a pattern similar to that of nitrite. Phaeo-pigment ranged from 0.04 to 4.02 mg/cu m. Meltwater fluorescence appears to scale with salinity. Diatoms are present at all sample levels in the ice cores, but in varying concentration and condition. Active growth occurs in the surface layers.

MP 1610

ATMOSPHERIC BOUNDARY LAYER MEASUREMENTS IN THE WEDDELL SEA.

Andreas, E.L., *Antarctic journal of the United States,* 1982, 17(5), p.113-115, 4 refs.
37-3965

ICE CONDITIONS, SEA ICE, WEDDELL SEA.

There was a very intensive atmospheric boundary layer sampling program carried out on the *Mikhail Somov* during the joint U.S.-U.S.S.R. Weddell Polynya Expedition. This program included upper-air soundings with two different radiosonde systems; surface-layer profiling with a boom instrumented at three levels; spectral measurements of surface-layer turbulence with fast responding velocity, temperature, and humidity sensors; and routine meteorological observations. This paper describes the instrumentation used for the measurements and presents some of the surface-layer temperature and dew-point profiles.

MP 1611

ARCTIC AND SUBARCTIC ENVIRONMENTAL ANALYSES UTILIZING ERTS-1 IMAGERY.

Anderson, D.M., et al, *U.S. National Aeronautics and Space Administration. Contractor report,* Aug. 23, 1973, NASA-CR-135523, 5p.
McKim, H.L., Haugen, R.K., Gatto, L.W., Slaughter, C.W., Marlar, T.
28-2984

REMOTE SENSING, ENVIRONMENTS, ERTS IMAGERY.

MP 1612

HEAT AND MOISTURE FLOW IN FREEZING AND THAWING SOILS—A FIELD STUDY.

Berg, R.L., Conference on soil-water problems in cold regions, Calgary, Alberta, Canada, May 6-7, 1975, Proceedings, 1975, p.148-160, 14 refs.
30-3338

ROADS, FROST HEAVE, FROZEN GROUND MECHANICS, MEASURING INSTRUMENTS, MATHEMATICAL MODELS.

The USACRREL Pavements Research Group has recently initiated a project to more adequately model the mechanism of frost heaving in soil-water systems. The project has three primary objectives: 1. Develop mathematical models incorporating heat flow, moisture flow and processes in the freezing zone, 2. Develop the necessary laboratory equipment and procedures to evaluate the required factors and to refine the mathematical models, 3. Develop adequate instrumentation and optimize locations of sensors for full scale field tests; install this instrumentation in test sections and obtain data necessary to validate the mathematical models.

MP 1613

STUDY OF CLIMATIC ELEMENTS OCCURRING CONCURRENTLY.

Bilello, M.A., International Geographical Congress, 23rd, Moscow, July-Aug. 1976, Proceedings. Vol.2, Moscow, 1976, p.23-30, In English.
31-1536

CLIMATOLOGY, LONG RANGE FORECASTING, CLIMATIC CHANGES.

MP 1614

USE OF COMPRESSED AIR FOR SUPERCOOLED FOG DISPERSAL.

Weinstein, A.I., et al, *Journal of applied meteorology,* Nov. 1976, 15(11), p.1226-1231, For another version of this paper see 31-1494. 8 refs.
Hicks, J.R.
31-1600

SUPERCOOLED FOG, FOG DISPERSAL, WEATHER MODIFICATION, ICE CRYSTAL FORMATION, COMPRESSED AIR.

Experiments have been performed under controlled and free environment conditions to determine the technical feasibility of using the cooling resulting from the adiabatic expansion of compressed air to initiate ice crystal production in a supercooled fog. These experiments have shown that for most supercooled temperatures, approximately 1000 cc of air when compressed to 60 psig and released through a supersonic nozzle will produce the same number of ice crystals as does the evaporation of 1 cc of liquid propane. It is estimated that a compressed air supercooled fog dispersal system would consume approximately 6% of the hydrocarbon fuel presently consumed by operational systems using liquid propane spray.

MP 1615

APPLICATION OF ICE ENGINEERING AND RESEARCH TO GREAT LAKES PROBLEMS.

Freitag, D.R., Federal Conference on the Great Lakes, 1st, Ann Arbor, Mich., Dec. 13-15, 1972. Proceedings. [Washington?], Environmental Protection Agency, [1972?], p.131-138.
31-1736

ICE BOOMS, ICE COMPRESSION, PILES, ICE CONTROL, ICE DISTRIBUTION, FREEZING POINTS, ENGINEERING, RESEARCH PROJECTS, UNITED STATES—GREAT LAKES.

MP 1616

SOME ELEMENTS OF ICEBERG TECHNOLOGY.

Weeks, W.F., et al, International Conference and Workshops on Iceberg Utilization for Fresh Water Production, Weather Modification, and Other Applications, 1st, Iowa State University, Ames, October 2-6, 1977. Proceedings. Edited by A.A. Husseiny, New York, Pergamon Press, 1978, p.45-98, 51 refs.
Mellor, M.
32-4714

ICEBERGS, ICE MECHANICS, ICE PHYSICS, ICE SHELVES, WATER SUPPLY, ICEBERG TOWING.

Many of the technical questions relating to iceberg transport are given brief, but quantitative, consideration. These include iceberg genesis and properties, the mechanical stability of icebergs at sea, towing forces and tug characteristics, drag coefficients, ablation rates, and handling and processing the iceberg at both the pick-up site and at the final destination.

In particular, the paper attempts to make technical information on glaciological and ice engineering aspects of the problem more readily available to the interested planner or engineer. (Auth.)

MP 1617
ICE AND SHIP EFFECTS ON THE ST. MARYS RIVER ICE BOOMS.

Perham, R.E., *Canadian journal of civil engineering*, June 1978, 5(2), p.222-230, 7 refs. See also 31-3424.
33-281
ICE BOOMS, ICE PRESSURE, ICE CONTROL, IMPACT STRENGTH, ICE LOADS, LOADS (FORCES), ICE NAVIGATION, RIVER ICE.

MP 1618
NUMERICAL SIMULATION OF AIR BUBBLER SYSTEMS.

Ashton, G.D., *Canadian journal of civil engineering*, June 1978, 5(2), p.231-238, 8 refs. See also 31-3438.
33-282
BUBBLING, ICE PREVENTION, ICE CONTROL, HEAT TRANSFER, MECHANICAL ICE PREVENTION, ANALYSIS (MATHEMATICS), EQUIPMENT.

MP 1619
DYNAMICS OF NEAR-SHORE ICE.

Kovacs, A., et al, Environmental assessment of the Alaskan continental shelf, Vol.2 Principal investigators' reports July-Sep. 1978. Boulder, Colorado, Environmental Research Laboratories, 1978, p.230-233.
Weeks, W.F.
33-3095
SEA ICE, FAST ICE.

The authors report briefly on a new ice pile-up southeast of Pt. Barrow and the status of various reports connected with their current studies.

MP 1620
ANISOTROPIC PROPERTIES OF SEA ICE IN THE 50-150 MHZ RANGE.

Kovacs, A., et al, Environmental assessment of the Alaskan continental shelf, Vol. 8, Transport. Principal investigators' annual reports for the year ending March 1979, Boulder, Colorado, Outer Continental Shelf Environmental Assessment Program, Oct. 1979, p.324-353, For another source see 34-963. 4 refs.
Morey, R.M.
34-3054
SEA ICE, ICE ELECTRICAL PROPERTIES, ANISOTROPY, ICE CRYSTAL STRUCTURE, ELECTROMAGNETIC PROPERTIES, OCEAN CURRENTS, REMOTE SENSING.

Results of impulse radar studies of sea ice near Prudhoe Bay, Alaska, show that where there is a preferred current direction under the ice cover the crystal structure of the ice becomes highly ordered. This includes a crystal structure with a preferred horizontal c-axis that is oriented parallel with the local current. The radar studies show that this structure behaves as an anisotropic dielectric. The result is that when electromagnetic energy is radiated from a dipole antenna in which the E-field is oriented perpendicular with the c-axis azimuth, no bottom reflection is detected. It was also found that the frequency dispersion of anisotropic sea ice varies in the horizontal plane and is related to the average bulk brine volume of the ice. The bulk dielectric constant of the ice, as determined from impulse travel time, shows little correlation with the coefficient of anisotropy.

MP 1621
SOUTH POLE ICE CORE DRILLING, 1981-1982.

Kuivinen, K.C., et al, *Antarctic journal of the United States*, 1982, 17(5), p.89-91, 7 refs.
Koci, B.R., Holdsworth, G.W., Gow, A.J.
37-3955
DRILLING, ICE CORING DRILLS, ICE CORES, ANTARCTICA—AMUNDSEN-SCOTT STATION.

A cooperative ice core drilling, core processing, and stratigraphic logging program was conducted at Amundsen-Scott Station during the 1981-82 season by investigators from the Polar Ice Coring Office (PICO), the National Hydrology Research Institute/Environment Canada (NHRI), and the U.S. Army Cold Regions Research and Engineering Laboratory (CRREL). A 202.4-m ice core was collected, logged and packaged in the field, and then shipped to the CRREL ice core storage facility, where it will be made available to the NSF-sponsored glaciologists for further analysis. In addition to work with the ice core, PICO team members collected three gas samples for the Physics Inst., Univ. of Bern, Switzerland and prepared the Gearhardt-Owen logging winch for use by Univ. of Wisconsin-Madison geophysicists in their sonic logging of the 900-m borehole at Dome C.

MP 1622
CONTINUUM SEA ICE MODEL FOR A GLOBAL CLIMATE MODEL.

Ling, C.H., et al, Sea ice processes and models. Edited by R.S. Pritchard, Seattle, University of Washington Press, 1980, p.187-196, 20 refs.
Rasmussen, L.A., Campbell, W.J.
35-2169
SEA ICE, DRIFT, ICE CONDITIONS, MATHEMATICAL MODELS, REMOTE SENSING, ICE MELTING, FREEZING, MICROWAVES, CLIMATE, MAPPING, RADIOMETRY, WEDDELL SEA.

The model developed by Campbell (1965) has been extended to a time-dependent, quasi-steady-state model that uses both the equation of continuity and the equation of momentum. It also incorporates an equation of state that relates the pressure of ice to its convergence. The constitutive equation is of a fluid type. The freezing and melting of sea ice is parameterized in terms of ice thickness, location, and season. For the 1974 austral winter twice-daily surface wind stress fields were generated from synoptic pressure data. For every third day of this period the boundaries and concentration of the Antarctic sea ice were mapped using ESMR (Electronically Scanning Microwave Radiometer) images acquired by the Nimbus-5 satellite. These data are used both as initial conditions and to compare the model results for various time periods.

MP 1623
REVIEW OF ELECTRICAL RESISTIVITY OF FROZEN GROUND AND SOME ELECTROMAGNETIC METHODS FOR ITS MEASUREMENT.

Arcone, S.A., *Materials performance*, 1979, 18(5), p.32-37, 16 refs.
33-4231
FROZEN GROUND PHYSICS, ELECTRICAL RESISTIVITY, ELECTROMAGNETIC PROSPECTING, GEOPHYSICAL SURVEYS, RADIO WAVES, SOIL MOISTURE CONTENT, SOIL TEMPERATURE, GRAIN SIZE, AIRBORNE RADAR, MEASURING INSTRUMENTS.

Results of extensive studies of earth resistivities of low temperature soils are presented. Ground measurements of the electromagnetic field components of radio waves propagated at low frequencies from distant transmitters and of the inductive coupling between two loop antennas are described. Results of measurements by these methods are compared with each other and with actual findings from excavations and borings at permafrost sites. The measurements are shown to provide data on locations of lens ice, indicate zones of thawing, give indications which permit estimating resistivities of layers and permit construction of a map of Alaska identifying major resistivity zones. Airborne evaluation of remotely propagated waves permits construction of resistivity contour maps. Reasons for variations in resistivity among various categories of frozen soils are discussed.

MP 1624
THERMAL AND RHEOLOGICAL COMPUTATIONS FOR ARTIFICIALLY FROZEN GROUND CONSTRUCTION.

Sanger, F.J., et al, International Symposium on Ground Freezing, 1st, Bochum, Mar. 8-10, 1978, Vol.2. Edited by H.L. Jessberger, Bochum, Ruhr University, 1978, p.95-117, 32 refs.
Sayles, F.H.
33-4283
SOIL FREEZING, THERMAL PROPERTIES, ARTIFICIAL FREEZING, FROZEN GROUND MECHANICS, FROZEN GROUND THERMODYNAMICS, CREEP PROPERTIES, RHEOLOGY, CONSTRUCTION, ANALYSIS (MATHEMATICS), FROST HEAVE.

MP 1625
ON FORECASTING MESOSCALE ICE DYNAMICS AND BUILD-UP.

Hibler, W.D., III, et al, *Annals of glaciology*, 1983, Vol.4, p.110-115, 10 refs.
Udin, I., Ullerstig, A.
37-4089
ICE PILEUP, ICE MECHANICS, ICE LOADS, ICE SOLID INTERFACE, WAVE PROPAGATION, OFFSHORE STRUCTURES, SHORES, ICE FORECASTING, SEA ICE, ICE COVER STRENGTH, ICE COVER THICKNESS, MATHEMATICAL MODELS.

Due to the nonlinear nature of the ice interaction, sea-ice build-up against coasts and structures is a complex process. This build-up significantly affects mesoscale (10 to 100 km) ice motions over typical forecast time scales of several days. To examine the ramifications of assuming a non-linear ice interaction in ice forecast models, we have carried out a series of idealized simulations employing a viscous plastic sea-ice rheology. These simulations employ constant wind fields at a grid resolution of 18.5 km and allow the ice to build up and strengthen. With the plastic ice interaction the ice build-up is found to take place by means of a ridging front. Depending on the nature of the strength-thickness coupling, this build-up is accompanied by kinematic wave propagation effects.

MP 1626
EXPERIMENTAL DETERMINATION OF THE BUCKLING LOADS OF FLOATING ICE SHEETS.

Sodhi, D.S., et al, *Annals of glaciology*, 1983, Vol.4, p.260-265, 12 refs.
Haynes, F.D., Kato, K., Hirayama, K.
37-4114
FLOATING ICE, ICE LOADS, STRUCTURES, ICE SOLID INTERFACE, ICE SHEETS, ICE PRESSURE, EXPERIMENTATION, PHOTOGRAPHY.

Experiments were performed to determine the forces required to buckle a floating ice sheet pushing against structures of different widths. The characteristic length of each ice sheet was determined to enable a comparison to be made between the theoretical and experimental results.

MP 1627
EXPERIMENTS ON ICE RIDE-UP AND PILE-UP.

Sodhi, D.S., et al, *Annals of glaciology*, 1983, Vol.4, p.266-270, 48 refs.
Hirayama, K., Haynes, F.D., Kato, K.
37-4115
ICE PILEUP, FLOATING ICE, STRUCTURES, ICE SOLID INTERFACE, ICE OVERRIDE, SHORES, BEACHES, SLOPE ORIENTATION, EXPERIMENTATION.

Ice pile-up and ride-up are common occurrences along beaches in the sub-Arctic and Arctic. An understanding of the factors which lead to pile-up is important for design of a defensive strategy to prevent damage to coastal installations. Since ice action on a sloping beach is complex, an experimental model study was undertaken to determine the factors which promote ice pile-up. The factors varied in this study were the freeboard, slope, and roughness of the beach. One experiment was performed to observe the effectiveness of a shore defense structure against ice ride-up.

MP 1628
ROOF MOISTURE SURVEYS: CURRENT STATE OF THE TECHNOLOGY.

Tobiasson, W., *Society of Photo-Optical Instrumentation Engineers. Proceedings*, 1983, Vol.371, p.24-31, 7 refs.
37-4035
ROOFS, MOISTURE DETECTION, INFRARED RECONNAISSANCE, MEASURING INSTRUMENTS.

Moisture is the big enemy of compact roofing systems. Nondestructive nuclear, capacitance and infrared methods can all find wet insulation in such roofs but a few core samples are needed for verification. Nuclear and capacitance surveys generate quantitative results at grid points but examine only a small portion of the roof. Quantitative results are not usually provided by infrared scanners but they can rapidly examine every square inch of the roof. Being able to find wet areas when they are small is an important advantage.

MP 1629
TRANSPORT OF WATER IN FROZEN SOIL. 1. EXPERIMENTAL DETERMINATION OF SOIL-WATER DIFFUSIVITY UNDER ISOTHERMAL CONDITIONS.

Nakano, Y., et al, *Advances in water resources*, Dec. 1982, 5(4), p.221-226, For Part 2 of this study (MP 1601), see 37-3558. 13 refs.
Tice, A.R., Oliphant, J.L., Jenkins, T.F.
37-4218
SOIL WATER MIGRATION, FROZEN GROUND PHYSICS, GROUND ICE, SOIL FREEZING.

A new experimental method for measuring the soil-water diffusivity of frozen soil under isothermal conditions is introduced. The theoretical justification of the method is presented and the feasibility of the method is demonstrated by experiments conducted using marine deposited clay. The measured values of the soil-water diffusivity are found comparable to reported experimental data. (Auth.)

MP 1630
ACOUSTIC EMISSIONS IN THE INVESTIGATION OF AVALANCHES.

St. Lawrence, W.F., Canadian Geotechnical Conference, 29th, Vancouver, B.C., 1976. Proceedings, Canadian Geotechnical Society, 1977, p.VII/24-VII/33, In English with French summary. 4 refs.
33-1598
SNOW DEFORMATION, ULTRASONIC TESTS, AVALANCHE MECHANICS, SNOW ACOUSTICS, SNOW COVER STABILITY.

MP 1631
NOTES AND QUOTES FROM SNOW AND ICE OBSERVERS IN ALASKA.

Bilello, M.A., *Western Snow Conference. Proceedings*, 1979, 47th, p.116-118.
38-104
SNOW SURVEYS, ICE SURVEYS, COST ANALYSIS, ORGANIZATIONS, UNITED STATES—ALASKA.

MP 1632
RELATIONSHIP BETWEEN THE ICE AND UNFROZEN WATER PHASES IN FROZEN SOILS AS DETERMINED BY PULSED NUCLEAR RESONANCE AND PHYSICAL DESORPTION DATA.
Tice, A.R., et al, *Journal of glaciology and cryopedology,* 1983, 5(2), p.37-46, In Chinese with English summary. For another version see 37-48. 14 refs.
Oliphant, J.L., Zhu, Y., Nakano, Y., Jenkins, T.F.
38-180
UNFROZEN WATER CONTENT, SOIL WATER, ICE WATER INTERFACE, GROUND ICE, FROZEN GROUND TEMPERATURE, FROZEN GROUND PHYSICS, NUCLEAR MAGNETIC RESONANCE, CLAY SOILS.

An experiment is described that demonstrates the balance between the ice and the unfrozen water in a frozen soil as water is removed. Nuclear magnetic resonance (NMR) is used to monitor the unfrozen water content as the soil is dehydrated by a molecular sieve material. Our results show that the unfrozen water content of a Morin clay soil remains constant until the total water content has been reduced to the point where no ice remains in the system.

MP 1633
MECHANISMS FOR ICE BONDING IN WET SNOW ACCRETIONS ON POWER LINES.
Colbeck, S.C., et al, *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* June 1983, 83-17, p.25-30, 9 refs.
Ackley, S.F.
38-427
POWER LINE ICING, ICE ADHESION, WET SNOW, ICE FORMATION, SNOW ACCUMULATION, PHASE TRANSFORMATIONS, GRAIN SIZE, TEMPERATURE EFFECTS.

MP 1634
HOW EFFECTIVE ARE ICEPHOBIC COATINGS.
Minsk, L.D., *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* June 1983, *83-17, p.93-95, 2 refs.*
38-435
PROTECTIVE COATINGS, ICE CONTROL, ICE PREVENTION, ICING, SHEAR STRENGTH, ICE STRENGTH, SURFACE PROPERTIES, ICE ADHESION, COUTERMEASURES, TESTS.

Much effort over many years has gone into the search for an effective, durable, easily applied and inexpensive material to eliminate the force of adhesion between ice and a substrate. The objective of zero ice adhesion on an unheated surface which would either prevent the formation of ice or ensure self-shedding of very thin accretions has not yet been achieved. Many commercially-available coatings do succeed in reducing the force of adhesion below 15 psi (103.4 kPa) and survive at least five freeze-release cycles, two arbitrarily established criteria. Exposure to rain erosion, however, increases the force of adhesion beyond this value for most materials. As part of a continuing project at CRREL, a test procedure for measuring the shear strength of ice at failure has been developed and a large number of candidate materials have been tested.

MP 1635
STUDIES OF HIGH-SPEED ROTOR ICING UNDER NATURAL CONDITIONS.
Itagaki, K., et al, *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* June 1983, 83-17, p.117-123, 2 refs.
Lemieux, G.E., Bosworth, H.W., O'Keefe, J., Hogan, G.
38-438
AIRCRAFT ICING, FREEZING NUCLEI, PROPELLERS, HELICOPTERS, TESTS.

Icing on high-speed rotors was studied under natural conditions on the summit of Mt. Washington. Differences in the growth conditions from those of laboratory tests, such as rapidly variable water supplies and abundant freezing nuclei, seem to have contributed to raising the temperature of the wet growth regime and producing finer crystals than in laboratory experiments.

MP 1636
APPLICATION OF A BLOCK COPOLYMER SOLUTION TO ICE-PRONE STRUCTURES.
Hanamoto, B., *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* June 1983, 83-17, p.155-158, 1 ref.
38-442
ICING, CHANNELS (WATERWAYS), LOCKS (WATERWAYS), PROTECTIVE COATINGS, ICE PREVENTION, POLYMERS, ICE NAVIGATION, ICE ADHESION, COUNTERMEASURES.

MP 1637
FIELD MEASUREMENTS OF COMBINED ICING AND WIND LOADS ON WIRES.
Govoni, J.W., et al, *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* June 1983, 83-17, p.205-215, 8 refs.
Ackley, S.F.
38-449
POWER LINE ICING, ICE ACCRETION, ICE LOADS, WIND PRESSURE, WIND DIRECTION, WIND VELOCITY, POWER LINE SUPPORTS.

Four winter field seasons of simulated power line icing data were obtained during the years 1977-1981. Measurements were obtained of the icing characteristics, loads on the wire, and wind conditions simultaneously. Loads were measured using a single-axis load cell in line with the wire during the first three seasons, and a tri-axial load cell (resolving three perpendicular force components) in the 1980-81 winter season. Winds were measured using a vaned pitot-static tube located near one end of the wire.

MP 1638
LANDSAT DIGITAL ANALYSIS OF THE INITIAL RECOVERY OF THE KOKOLIK RIVER TUNDRA FIRE AREA, ALASKA.
Hall, D.K., et al, *U.S. National Aeronautics and Space Administration. Technical memorandum,* Dec. 1979, No.80602, 15p., 7 refs.
Ormsby, J.P., Johnson, L., Brown, J.
38-483
TUNDRA, FIRES, REVEGETATION, REMOTE SENSING, LANDSAT, UNITED STATES—ALASKA—KOKOLIK RIVER.

MP 1639
SURVEY OF METHODS FOR SOIL MOISTURE DETERMINATION.
Schmugge, T.J., et al, *U.S. National Aeronautics and Space Administration. Technical memorandum,* Nov. 1979, No.80658, 74p., Refs. p.45-60.
Jackson, T.J., McKim, H.L.
38-484
SOIL WATER, REMOTE SENSING, GRAVIMETRIC PROSPECTING, ELECTROMAGNETIC PROSPECTING, EVAPOTRANSPIRATION, VEGETATION FACTORS, PRECIPITATION (METEOROLOGY).

MP 1640
GUIDEBOOK TO PERMAFROST AND RELATED FEATURES ALONG THE ELLIOTT AND DALTON HIGHWAYS, FOX TO PRUDHOE BAY, ALASKA.
Brown, J., ed, International Conference on Permafrost, 4th, July 18-22, 1983, Fairbanks, University of Alaska, ⌈1983⌉, 230p., Guidebook No.4. Refs. p.213-225.
Kreig, R.A., ed.
38-521
PERMAFROST PHYSICS, MANUALS, ROADS, ECOLOGY, CLIMATOLOGY, HYDROLOGY, VEGETATION, GEOLOGY, GROUND ICE, UNITED STATES—ALASKA.

MP 1641
MEASUREMENT OF ICE FORCES ON STRUCTURES.
Sodhi, D.S., et al, Design for ice forces. Edited by S.R. Caldwell and R.D. Crissman, New York, N.Y., American Society of Civil Engineers, 1983, p.139-155, 27 refs.
Haynes, F.D.
38-598
ICE LOADS, ICE PRESSURE, OFFSHORE STRUCTURES, IMPACT STRENGTH, ICE STRENGTH, RIVER ICE, LAKE ICE, ICE MECHANICS, STRAINS, TIME FACTOR, MEASURING INSTRUMENTS.

Methodologies and techniques are discussed for measuring ice forces on fixed structures situated in rivers and lakes. The usual method of measuring ice forces is to place a load frame between the moving ice and the structure and to measure the reactive forces with load cells or strain gages. Another method is to measure the acceleration, displacement or strain at a few points on the test structure and relate the measurements to ice forces. The size and shape of the force measuring system depend upon the mode of ice failure, the distribution of the ice forces and the logistics associated with each site. The variations of ice force with respect to time are generally very high during crushing and impact, and the response of the force-measuring system should be sufficiently fast.

MP 1642
METHODS OF ICE CONTROL.
Frankenstein, G.E., et al, Design for ice forces. Edited by S.R. Caldwell and R.D. Crissman, New York, N.Y., American Society of Civil Engineers, 1983, p.204-215, 7 refs.
Hanamoto, B.
38-602
ICE LOADS, ICE CONTROL, ICE NAVIGATION, LOCKS (WATERWAYS), CHANNELS (WATERWAYS), ICEBREAKERS, CHEMICAL ICE PREVENTION, ICE REMOVAL, ELECTRICAL MEASUREMENT, AIR CUSHION VEHICLES, PROTECTIVE COATINGS.

Methods of ice control in navigable waters including locks are presented. Ice carried downstream by ship traffic causes operational problems in and around the lock areas as well as in restricted channels. The paper discusses chemical, electrical, and mechanical methods of ice control. The use of air cushion vehicles and ice breaking ships for ice control is also discussed.

MP 1643
ICE ACTION ON TWO CYLINDRICAL STRUCTURES.
Kato, K., et al, Offshore Technology Conference, 15th, Houston, Texas, May 2-5, 1983. Proceedings. Vol.1, 1983, p.159-166, 17 refs.
Sodhi, D.S.
38-641
ICE LOADS, STRUCTURES, ICE PRESSURE, ICE SOLID INTERFACE, EXPERIMENTATION, PIPES (TUBES).

Ice action on two cylindrical structures, located side by side, has been investigated in a small-scale experimental study to determine the interference effects on the ice forces generated during ice structure interaction. The proximity of the two structures changes the mode of ice failure, the magnitude and direction of ice forces on the individual structure, and the dominant frequency of ice force variations. Interference effects were determined by comparing the experimental results of tests at different structure spacings.

MP 1644
ICE JAMS IN SHALLOW RIVERS WITH FLOODPLAIN FLOW.
Calkins, D.J., *Canadian journal of civil engineering,* Sep. 1983, 10(3), p.538-548, 14 refs.
38-776
ICE JAMS, RIVER ICE, RIVER FLOW, ICE CONDITIONS, ICE COVER THICKNESS, FLOATING ICE, HYDRAULICS, FLOODS, PLAINS, COMPUTER APPLICATIONS.

The equilibrium ice jam thickness given by Pariset et al, is modified to yield a clearer, consistent relationship between the flow hydraulics and thickness. The modified equations are analyzed with respect to a floating ice jam in the main channel with flow also occurring in the floodplain. The final derivation allows the expected ice jam thickness to be computed, given the bed and ice cover thickness. The analytical computation for the ice jam thicknesses is compared with prototype data on ice jam thicknesses from four shallow rivers which had significant floodplain flow with the ice jam event.

MP 1645
ASYMMETRIC PLANE FLOW WITH APPLICATION TO ICE JAMS.
Tatinclaux, J.C., et al, *Journal of hydraulic engineering,* Nov. 1983, 109(11), p.1540-1556, 17 refs.
Gögüs, M.
38-1629
ICE JAMS, WATER FLOW, FLOW RATE, SHEAR STRESS, FRICTION, SURFACE ROUGHNESS, VELOCITY, ANALYSIS (MATHEMATICS), TURBULENT FLOW.

An available turbulence method is used to prove that in plane flows between two boundaries with asymmetric roughness the plane of maximum velocity is not the plane of zero shear stress. By dividing the flow at the plane of zero shear stress, laboratory and field data on flows below simulated and actual ice jams are analyzed to derive equations for the boundaries friction factors in terms of mean flow velocity, depth of flow zone, and boundary roughness for smooth and fully rough boundaries. These equations are applied to the calculations of ice jam characteristics. For the jams studied, the present method gives a variation of about 10% in the jam characteristics with a method based on dividing the flow at the plane of maximum velocity.

MP 1646

OPTICAL ENGINEERING FOR COLD ENVIRONMENTS.

Aitken, G.W., ed, *Society of Photo-Optical Instrumentation Engineers. Proceedings,* 1983, Vol.414, Meeting on Optical Engineering for Cold Environments, Arlington, VA, April 7-8, 1983. Proceedings, 225p., Refs. passim. For selected papers see 38-1032 through 38-1057.

38-1031

COLD WEATHER PERFORMANCE, SPECTROSCOPY, LOW TEMPERATURE RESEARCH, REMOTE SENSING, WAVE PROPAGATION, MEASURING INSTRUMENTS, ENGINEERING, SNOWFALL.

MP 1647

TECHNIQUE FOR MEASURING THE MASS CONCENTRATION OF FALLING SNOW.

Lacombe, J., *Society of Photo-Optical Instrumentation Engineers. Proceedings,* 1983, Vol.414, p.17-28, 14 refs.

38-1035

SNOWFALL, MEASURING INSTRUMENTS, PRECIPITATION GAGES, VELOCITY, ELECTROMAGNETIC PROPERTIES, ANALYSIS (MATHEMATICS).

A system has been developed by the U.S. Army Cold Regions Research and Engineering Laboratory to measure the mass concentration of falling snow crystals. It is known as ASCME (Airborne Snow Concentration Measuring Equipment) and is described in this paper. ASCME's general performance has been evaluated based on concurrent measurements of precipitation rate. A strong correlation between airborne-snow mass concentration and precipitation rate yields an estimate of particle fall velocity close to that observed by other researchers. Factors affecting system accuracy have been investigated and are discussed. Examples are given of the utilization of ASCME data in analyses of electromagnetic energy propagation in falling snow. (Auth.)

MP 1648

CHARACTERIZATION OF SNOW FOR EVALUATION OF ITS EFFECT ON ELECTROMAGNETIC WAVE PROPAGATION.

Berger, R.H., *Society of Photo-Optical Instrumentation Engineers. Proceedings,* 1983, Vol.414, p.35-42, 9 refs.

38-1037

SNOWFALL, SNOWFLAKES, ELECTROMAGNETIC PROPERTIES, PARTICLE SIZE DISTRIBUTION, SPECTROSCOPY, MEASURING INSTRUMENTS, SNOW CRYSTALS, TURBULENT BOUNDARY LAYER.

Snow as an obscurant presents some interesting challenges to those attempting to characterize it. The wide range of particle sizes which can be present at any instant, and the intricate and varied particle geometry, which makes particle orientation an important consideration in snow characterization and extinction measurements, both call for the use of special measurement techniques. The application of particle size spectrometer probes to the measurement of distributions and area concentrations for snow crystals and flakes in the 12.5- to 6200-micron size range is described. (Auth.)

MP 1649

PROGRESS IN METHODS OF MEASURING THE FREE WATER CONTENT OF SNOW.

Fisk, D.J., *Society of Photo-Optical Instrumentation Engineers. Proceedings,* 1983, Vol.414, p.48-51, 3 refs.

38-1039

SNOW WATER CONTENT, SNOW ELECTRICAL PROPERTIES, MEASURING INSTRUMENTS, SNOW COVER EFFECT, ELECTROMAGNETIC PROPERTIES, SNOW MELTING, BACKSCATTERING, ABSORPTION, WAVE PROPAGATION, FREEZE THAW CYCLES.

Providing ground truth for the backscatter and absorption effects of a snow cover on electromagnetic waves has long been a problem. One characteristic of the snow cover which has been particularly difficult to measure is its free, or liquid, water content—the fraction of the snow's volume which exists in the liquid state. Five methods which have been used for measuring this parameter are described and their merits and deficiencies are discussed. Two of the methods are calorimetric, measuring the free water content as a function of the heat added to or removed from a snow sample while completely melting or freezing it. The third uses the freezing point depression observed on adding a salt solution to a snow sample to calculate the snow's free water content. In the fourth procedure, a snow sample is completely dissolved in ethyl or methyl alcohol. The corresponding decrease in temperature is inversely related to the free water content of the snow. The final technique is electronic: above a certain frequency, the electrical capacitance of snow is related to its density and free water content. With accurate calibration, devices which measure snow capacitance are likely to be the simplest and fastest means of providing free water measurements. (Auth.)

MP 1650

COMMENTS ON THE METAMORPHISM OF SNOW.

Colbeck, S.C., *Society of Photo-Optical Instrumentation Engineers. Proceedings,* 1983, Vol.414, p.149-151.

38-1051

METAMORPHISM (SNOW), SNOWFALL, SNOW CRYSTAL GROWTH, GRAIN SIZE, TEMPERATURE GRADIENTS, CLIMATIC FACTORS, WET SNOW.

Snow precipitation takes a variety of forms depending on the conditions in the atmosphere at the time of the snowfall. Regardless of what particular conditions prevail at that time, once the snow particles reach the ground they immediately begin changing. This is not surprising since the snow cover is at or close to its melting temperature, has a very large specific surface area, and has ever changing boundary conditions. Wet snow and dry snow are very different materials. They have different properties and even looked different. They both undergo metamorphism but by different processes. They are treated separately here. Dry snow is treated first because dry snowfall followed some time later by melting is the normal sequence of events. (Auth.)

MP 1651

LANDSAT-4 THEMATIC MAPPER (TM) FOR COLD ENVIRONMENTS.

Gervin, J.C., et al, *Society of Photo-Optical Instrumentation Engineers. Proceedings,* 1983, Vol.414, p.179-186, 28 refs.

McKim, H.L., Salomonson, V.V.

38-1054

REMOTE SENSING, SPECTROSCOPY, SNOW COVER, ICE CONDITIONS, SNOW WATER CONTENT, TOPOGRAPHIC SURVEYS, LANDSAT, CLOUD COVER, MAPPING.

The TM aboard Landsat-4 launched on July 16, 1982, represents a major advance in Earth resources sensors. Its seven spectral bands record surface radiation in blue, green, red, near infrared, middle infrared and thermal wavelengths. The spatial resolution of approximately 30 meters represents a sevenfold increase over the previous Landsat sensor, the multispectral scanner subsystem (MSS). In addition, TM has greater radiometric sensitivity, distinguishing 256 quantization levels, compared with 64 for the MSS. These potential improvements have significant implications for satellite remote sensing in cold environments. The addition of the middle infrared bands will permit clouds to be distinguished from snow. It may also be possible to relate spectral response in this range to snow condition and hence water content. The thermal band responds to differences in surface temperature, which may be related to variations in soil moisture and drainage. These are important considerations for cold region construction. (Auth.)

MP 1652

EFFECT OF COLOR AND TEXTURE ON THE SURFACE TEMPERATURE OF ASPHALT CONCRETE PAVEMENTS.

Berg, R.L., et al, International Conference on Permafrost, 4th, Fairbanks, Alaska, July 17-22, 1983. Proceedings, Washington, D.C., National Academy Press, 1983, p.57-61, 11 refs.

Esch, D.C.

38-1110

PERMAFROST BENEATH ROADS, PAVEMENTS, BITUMINOUS CONCRETES, SURFACE TEMPERATURE, WIND VELOCITY, PROTECTIVE COATINGS, TESTS.

During the fall of 1981 and the spring of 1982, eight test items were established on an asphalt pavement in Fairbanks, Alaska. The test items were: two sections of untreated pavement, yellow-painted pavement, white-painted pavement, "standard" chip seal, fine-grained "standard" chip seal, chip seal with dark brown aggregate, and chip seal with white marble aggregate. The test items were located on a main road. Surface temperatures were monitored hourly by thermocouples attached to an automatic data collection system. The ambient air temperature, wind speed and direction, amount of precipitation, and radiation balance were continuously recorded at an untrafficked pavement approximately 100 m from the test items. Incident and reflected shortwave radiation measurements were made nearly every weekday over each test item using a hand-held radiometer. N-factors, ratios of surface thawing indexes to air thawing indexes varied from about 1.2-1.3 for the white- and yellow-painted surfaces, respectively, to about 1.4-1.5 for the other surfaces.

MP 1653

OBSERVATIONS ON ICE-CORED MOUNDS AT SUKAKPAK MOUNTAIN, SOUTH CENTRAL BROOKS RANGE, ALASKA.

Brown, J., et al, International Conference on Permafrost, 4th, Fairbanks, Alaska, July 17-22, 1983. Proceedings. Washington, D.C., National Academy Press, 1983, p.91-96.

Nelson, F., Brockett, B.E., Outcalt, S.I., Everett, K.R.

38-1116

FROST MOUNDS, TOPOGRAPHIC FEATURES, GROUND ICE, UNFROZEN WATER CONTENT, GEOMORPHOLOGY, PERMAFROST DISTRIBUTION, PERMAFROST HYDROLOGY, SLOPES, MOUNTAINS, UNITED STATES—ALASKA—SUKAKPAK MOUNTAINS.

Several hundred mounds occur on the lower slope of Sukakpak Mountain. The mean mound height is approximately 1 m and most are elliptical or circular in plan. Clear, massive ice can be found within, below, and adjacent to some mounds. Within and adjacent to one mound, free water under low pressure was observed in late winter. Frozen sediments were found below the water lens. Trees with smooth trunk curvature on top of the mounds suggest long period of stability. Most mounds are found in active drainage channels that develop thick surface icings each winter. As a tentative hypothesis, it is suggested that the mounds form by closed-system freezing at sites with higher moisture contents than their surroundings. The causes and frequency of occurrence and annual magnitude of this upheaving are under investigation.

MP 1654

RUNOFF FROM A SMALL SUBARCTIC WATERSHED, ALASKA.

Chacho, E.F., et al, International Conference on Permafrost, 4th, Fairbanks, Alaska, July 17-22, 1983. Proceedings, Washington, D.C., National Academy Press, 1983, p.115-120, 17 refs.

Bredthauer, S.

38-1120

PERMAFROST BENEATH RIVERS, RUNOFF, STREAM FLOW, WATERSHEDS, DISCONTINUOUS PERMAFROST, SNOWMELT, PRECIPITATION (METEOROLOGY), MOSSES, SLOPES, EVAPOTRANSPIRATION.

Precipitation-runoff ratios were measured on Glenn Creek, a small, second-order, subarctic stream located near Fairbanks, Alaska, in the Yukon, Tanana Upland physiographic province. Glenn Creek drains a watershed of 2.25 sq km, of which 70% is underlain by permafrost. A Parshall flume was used to measure streamflow, and a pair of 1.22 m by 2.44 m lysimeters were used to measure precipitation and runoff from the moss-covered permafrost slope. The data from one summer season (1979) and one snowmelt season (1980) indicate the sloping surfaces of the watershed have a very fast response time, long recession, and subsurface runoff prior to complete saturation of the overlying organic material. Glenn Creek streamflow is comparable to the lysimeter runoff with regard to response time and runoff recession, however the watershed precipitation-runoff ratio is much lower. This is attributed to longer travel distances in the watershed, which result in greater evapotranspiration losses, little contribution from the non-permafrost areas, and only partial areas of the watershed contributing to the streamflow.

MP 1655

FROST HEAVE OF SALINE SOILS.

Chamberlain, E.J., International Conference on Permafrost, 4th, Fairbanks, Alaska, July 17-22, 1983. Proceedings, Washington, D.C., National Academy Press, 1983, p.121-126, 8 refs.

38-1121

SALINE SOILS, FROST HEAVE, SOIL CHEMISTRY, SOIL FREEZING, ICE LENSES, BRINES, SHEAR STRESS, TESTS.

Theories of ice segregation and frost heave processes in saline soils are briefly examined and modified to explain observations made on clay and sand soils frozen under laboratory conditions. Seawater was observed to reduce the rate of frost heave by more than 50% for both soil types and to dramatically reduce the size of ice lenses. The effect of seawater is to cause the formation of a thick active freezing zone with many ice lens growth sites, each with its own brine concentration. Unbounded brine-rich soil zones between ice lenses are identified as potential zones of low shear strength.

MP 1656

LONG-TERM ACTIVE LAYER EFFECTS OF CRUDE OIL SPILLED IN INTERIOR ALASKA.

Collins, C.M., International Conference on Permafrost, 4th, Fairbanks, Alaska, July 17-22, 1983. Proceedings, Washington, D.C., National Academy Press, 1983, p.175-179, 19 refs.

38-1131

OIL SPILLS, ACTIVE LAYER, ENVIRONMENTAL IMPACT, THAW DEPTH, ALBEDO, SEASONAL VARIATIONS, TEMPERATURE EFFECTS, UNITED STATES—ALASKA.

Two experimental oil spills of 7570 liters each were conducted at a black-spruce-forested site in February and July of 1976.

The long-term effects of the spills on the active layer were directly related to the method of oil movement. The winter spill moved beneath the snow, within the surface moss layer, and the summer spill moved primarily below the moss, in the organic soil. The summer spill affected an area nearly one and one-half times that of the winter spill. Only 10% of the 303 sq m summer spill area had oil visible on the surface, while 40% of the 188 sq m winter spill had visible oil. Thaw depths in the summer spill area increased from 1977 to 1980—average thaw depth was 72 cm vs. 48 cm in the control—and remained essentially the same in 1981 and 1982. Thaw depths in the winter spill area continued to increase until 1982 to an average of 92 cm. Summer temperatures 5 cm under the blackened moss are consistently higher than under the undisturbed surface. Presumably the change in albedo due to the surface oil accounts for the increased thaw in the winter spill area.

MP 1657
FIELD TESTS OF A FROST-HEAVE MODEL.

Guymon, G.L., et al, International Conference on Permafrost, 4th, Fairbanks, Alaska, July 17-22, 1983. Proceedings, Washington, D.C., National Academy Press, 1983, p.409-414, 9 refs.
Berg, R.L., Hromadka, T.V., II.
38-1175
FROST HEAVE, FROST PENETRATION, FREEZE THAW CYCLES, SOIL CREEP, SOIL TEMPERATURE, GROUND WATER, WATER PRESSURE, WATER LEVEL, MATHEMATICAL MODELS, ICE LENSES, ICE MELTING.

A one-dimensional mathematical model of frost heave based upon a nodal domain integration analog is compared to data collected from a Winchendon, Mass., field site. Air and soil temperatures, pore water pressures, and groundwater level data were collected on test sections containing six different soils during the winters of 1978-1979 and 1979-1980. The soil samples were evaluated in the laboratory to determine soil moisture characteristics, hydraulic conductivity as a function of pore water tensions, density, and other parameters. The parameters were used together with assumed thermal parameters in a one-dimensional model that calculates the distributions of temperature and moisture content as well as the amount of ice segregation (vertically lumped frost heave) and thaw consolidation. Using measured air and soil surface temperatures as input data, the simulated frost heave and thaw consolidation agreed well with measured ground surface displacements that resulted from ice segregation or ice lens melting.

MP 1658
RELATIONSHIPS BETWEEN ESTIMATED MEAN ANNUAL AIR AND PERMAFROST TEMPERATURES IN NORTH-CENTRAL ALASKA.

Haugen, R.K., et al, International Conference on Permafrost, 4th, Fairbanks, Alaska, July 17-22, 1983. Proceedings, Washington, D.C., National Academy Press, 1983, p.462-467, 13 refs.
Outcalt, S.I., Harle, J.C.
38-1184
PERMAFROST THERMAL PROPERTIES, AIR TEMPERATURE, FROZEN GROUND TEMPERATURE, PERMAFROST DISTRIBUTION, SOIL TEMPERATURE, UNITED STATES—ALASKA.

Mean annual air temperatures (MAAT) are estimated for a transect from central to northern Alaska. The estimated MAAT are compared to mean annual ground temperatures (MAGT) representative of upper permafrost temperatures. The estimation of MAAT for the remote and topographically complex transect area was based on trend surface estimates of numerous short-term (1-7 years) temperature records obtained from climatic stations operated by research projects and longer records from existing National Weather Service stations. The standard error of the estimated MAAT falls within a degree (C) of observed MAAT for stations with long-term records. The MAGT are based on subsurface thermistor measurements made at construction sites and are therefore from disturbed terrain, but data were selected to minimize the effects of disturbance. MAGT measurements ranged from -7.5 C, in the north to -0.7 C near Fairbanks. Predicted MAAT ranged from -11.5 C at Prudhoe Bay to -4.5 C in the Fairbanks area.

MP 1659
COMPARISON OF TWO-DIMENSIONAL DOMAIN AND BOUNDARY INTEGRAL GEOTHERMAL MODELS WITH EMBANKMENT FREEZE-THAW FIELD DATA.

Hromadka, T.V., II, et al, International Conference on Permafrost, 4th, Fairbanks, Alaska, July 17-22, 1983. Proceedings. Washington, D.C., National Academy Press, 1983, p.509-513.
Guymon, G.L., Berg, R.L.
38-1192
EMBANKMENTS, FREEZE THAW CYCLES, THERMAL PROPERTIES, THAW DEPTH, FROST PENETRATION, PAVEMENTS, RUNWAYS, MATHEMATICAL MODELS, TEMPERATURE VARIATIONS, COMPUTERIZED SIMULATION.

The time- and position-dependent locations of the 0 C isotherm were calculated using two modelling strategies: a domain method and a boundary integral method. Simulations were made for the runway embankment at Deadhorse Airport near Prudhoe Bay, Alaska. The same thermal properties, initial conditions, and boundary conditions were used in both models. Sinusoidal surface temperature variations, dependent upon surface type and exposure, were used in the simulations rather than measured surface temperatures. The positions of the 0 C isotherm determined by the boundary integral method near the time of maximum thaw penetration were essentially the same as those determined by the finite element method, and results from both models agreed closely, within a few centimeters over a total freezing depth of about 2.5 m, with the measured positions. The largest differences between measured and computed positions occurred early in the freezing and thawing seasons. The primary advantage of using the boundary integral method for problems specifically of the type considered herein is that it requires only a few nodal points, so computer simulations can be completed rapidly on a micro computer. If the two-dimensional thermal regime is necessary, the finite element method is most suitable.

MP 1660
RECOVERY AND ACTIVE LAYER CHANGES FOLLOWING A TUNDRA FIRE IN NORTHWESTERN ALASKA.

Johnson, L., et al, International Conference on Permafrost, 4th, Fairbanks, Alaska, July 17-22, 1983. Proceedings. Washington, D.C., National Academy Press, 1983, p.543-547.
Viereck, L.
38-1198
TUNDRA, FIRES, REVEGETATION, PERMAFROST, ACTIVE LAYER, THAW DEPTH, GROUND ICE, HUMMOCKS, SOIL TEMPERATURE.

An upland tundra fire, started by lightning, burned 48 sq km near the Kokolik River in northwestern Alaska during late July and early August 1977. Permanent plots were established to monitor recovery of severely, moderately, and lightly burned areas as well as unburned tundra. During the following 5 years the original permanent plots and other portions of the burn were observed annually. Vegetative recovery was most rapid and active layer effects were least on the moist sedge-shrub tundra. Recovery was slower on a high-centered polygonal area and on severely burned tussock tundra. By August 1979 the sedge-shrub vegetation had largely recovered while both the polygonal ground and the tussock tundra were still readily recognizable as burned areas. Accelerated hydraulic and thermal erosion had occurred on some slopes, resulting in exposures of massive bodies of ground ice. Active layer thicknesses averaged 27 cm in the unburned areas and 35 cm within severely burned areas in August 1977 and reached a maximum at all but one site in August 1979. Depth of thaw decreased between 1979 and 1982 in the sedge-shrub tundra and in the lightly burned shrub tundra and remained at the same increased level through 1982 at all other sites.

MP 1661
GROUND ICE IN PERENNIALLY FROZEN SEDIMENTS, NORTHERN ALASKA.

Lawson, D.E., International Conference on Permafrost, 4th, Fairbanks, Alaska, July 17-22, 1983. Proceedings, Washington, D.C., National Academy Press, 1983, p.695-700, 23 refs.
38-1225
GROUND ICE, PERMAFROST HYDROLOGY, PERMAFROST THERMAL PROPERTIES, SEDIMENTS, ICE VOLUME, GROUND THAWING, GRAIN SIZE, LANDFORMS, FREEZE THAW CYCLES, AERIAL SURVEYS.

The distribution and volume of ice in perennially frozen sediments beneath three unglaciated sites in northern Alaska vary with the grain size and depositional origins of the sediment, thermal history (permafrost aggradation and degradation), and age of the terrain and deposits. Substantial lateral variation in near-surface ice volume exists between and within each site, but reasonably consistent trends in ice content with depth were measured beneath individual landforms. Primary deposits, those deposited and frozen without postdepositional thermal or sedimentologic modification, contain the highest volume of ice at each locality. Sediments that have undergone thawing or resedimentation typically contain much less excess ice. Thaw lake, slope, or fluvial processes modify ice contents and produce sedimentary sequences with a spatial distribution of ice determined by these depositional processes and the subsequent thermal history.

MP 1662
THAWING BENEATH INSULATED STRUCTURES ON PERMAFROST.

Lunardini, V.J., International Conference on Permafrost, 4th, Fairbanks, Alaska, July 17-22, 1983. Proceedings, Washington, D.C., National Academy Press, 1983, p.750-755, 20 refs.
38-1235
PERMAFROST BENEATH STRUCTURES, GROUND THAWING, THERMAL INSULATION, HEAT TRANSFER, PHASE TRANSFORMATIONS, DESIGN, ANALYSIS (MATHEMATICS).

The problem of thawing beneath heated structures on permafrost (or cooled structures in nonpermafrost zones) must be addressed if safe engineering designs are to be conceived. In general there are no exact solutions to the problem of conduction heat transfer with phase change for practical geometries. The quasi-steady approximation is used to solve the phase-change problem for insulated geometries, including infinite strips, rectangular buildings, and circular storage tanks. Analytical solutions are presented and graphed for a range of parameters with practical importance.

MP 1663
INVESTIGATION OF TRANSIENT PROCESSES IN AN ADVANCING ZONE OF FREEZING.

McGaw, R., et al, International Conference on Permafrost, 4th, Fairbanks, Alaska, July 17-22, 1983. Proceedings, Washington, D.C., National Academy Press, 1983, p.821-825, 9 refs.
Berg, R.L., Ingersoll, J.W.
38-1248
SOIL FREEZING, GROUND WATER, WATER PRESSURE, UNFROZEN WATER CONTENT, ICE LENSES, TEMPERATURE EFFECTS, TENSILE PROPERTIES, LIQUID PHASES, WATER TABLE, TESTS.

Studies have indicated a relation between subfreezing temperature in a fine-grained soil and pressure (moisture tension) in the film water adjacent to an ice lens. During the experiments reported here, concurrent measurements were obtained of temperature and pressure in the liquid water phase of a freezing silt soil. Freezing was from the top down utilizing an open system, with the water table held at the base of a specimen 30 cm long. The freezing front advanced into the specimen at a generally decreasing rate from 20 mm/day to 5 mm/day. The tests utilized a special tensiometer developed at CRREL that continues to measure moisture tension below a temperature of 0 C as long as continuity with the unfrozen water is maintained. Moisture tensions were registered continuously up to 75 kPa (0.75 atm), after which the tension remained constant or decreased slightly.

MP 1664
SOIL-WATER DIFFUSIVITY OF UNSATURATED FROZEN SOILS AT SUBZERO TEMPERATURES.

Nakano, Y., et al, International Conference on Permafrost, 4th, Fairbanks, Alaska, July 17-22, 1983. Proceedings, Washington, D.C., National Academy Press, 1983, p.889-893, 26 refs.
Tice, A.R., Oliphant, J.L., Jenkins, T.F.
38-1260
UNFROZEN WATER CONTENT, SOIL WATER, DIFFUSION, WATER TRANSPORT, TEMPERATURE EFFECTS, WATER CONTENT, GROUND ICE.

The soil-water diffusivities of soils containing no ice were determined at -1 C by an experimental method recently introduced. The theoretical basis of the method is presented. The measured diffusivities of three kinds of soils are found to have a common feature in that the diffusivity increases with increasing water content, attains a peak, and increases again as the water content increases. This common feature of the soils at the subzero temperature is discussed in comparison with unfrozen soils. The experimental data appear to indicate that the basic transport mechanism of water in soils containing no ice at the subzero temperature is essentially the same as that in unfrozen soils containing a small amount of water.

MP 1665
SEISMIC VELOCITIES AND SUBSEA PERMAFROST IN THE BEAUFORT SEA, ALASKA.

Neave, K.G., et al, International Conference on Permafrost, 4th, Fairbanks, Alaska, July 17-22, 1983. Proceedings, Washington, D.C., National Academy Press, 1983, p.894-898, 17 refs.
Sellmann, P.V.
38-1261
SUBSEA PERMAFROST, PERMAFROST DISTRIBUTION, SEISMIC REFRACTION, GROUND ICE, PERMAFROST DEPTH, SEISMIC VELOCITY, BEAUFORT SEA.

The distribution of high-velocity material was used as an indicator of ice-bonded permafrost. Observations from ice survey and marine seismic records, coupled with control from a small number of drill holes, suggest that ice-bonded permafrost is extremely widespread in the Beaufort Sea. Large areas of high-velocity material at shallow depths, 10-40 m below the seabed, were observed near Prudhoe and Harrison Bays. In some cases these zones extended up to 35 km from shore. It was also common to find that depths to the high-velocity material increased with distance from the shore. Observed depths were as great as 150-230 m below the seabed.

MP 1666

WATER MIGRATION DUE TO A TEMPERATURE GRADIENT IN FROZEN SOIL.

Oliphant, J.L., et al, International Conference on Permafrost, 4th, Fairbanks, Alaska, July 17-22, 1983. Proceedings, Washington, D.C., National Academy Press, 1983, p.951-955, 10 refs.

Tice, A.R., Nakano, Y.

38-1272

PERMAFROST HYDROLOGY, FROZEN GROUND PHYSICS, SOIL WATER MIGRATION, UNFROZEN WATER CONTENT, BOUNDARY LAYER, TEMPERATURE GRADIENTS, EXPERIMENTATION.

Closed soil columns at an initially uniform total water content were subjected to a nearly linear and constant temperature gradient along their length. At various times, the columns were sectioned and water content as a function of position was determined gravimetrically. Unfrozen water content vs. temperature curves were also determined with a nuclear magnetic resonance technique on separate samples of the same soil at the same dry density. It was found that the water migrated from the warm to the cold end and two zones developed in each of the tubes, one that contained only liquid water and the other containing ice and water. The boundary between the two zones also migrated toward the cold end as the experiment progressed, and the water content of the zone containing only water fell while that of the zone containing ice and water increased.

MP 1667

***ATMOSPHERIC* BOUNDARY-LAYER MODIFICATION, DRAG COEFFICIENT, AND SURFACE HEAT FLUX IN THE ANTARCTIC MARGINAL ICE ZONE.**

Andreas, E.L., et al, *Journal of geophysical research,* Jan. 20, 1984, 89(C1), p.649-661, 71 refs.

Tucker, W.B., Ackley, S.F.

38-1819

BOUNDARY LAYER, METEOROLOGICAL INSTRUMENTS, HEAT FLUX, ICE EDGE, RADIOSONDES.

During a traverse of the Antarctic marginal ice zone (MIZ) near the Greenwich Meridian in October 1981, we launched a series of radiosondes along a 150-km track starting at the ice edge. Since the the wind was from the north, off the ocean, these radiosonde profiles showed profound modification of the atmospheric boundary layer (ABL), as the increasing surface roughness decelerated the flow. The primary manifestation of this modification was a lifting of the inversion layer with increasing distance from the ice edge by the induced vertical velocity. But there was also a cooling of the stably stratified mixed layer below the inversion and a consequent flux of sensible heat to the surface that averaged over 200 W/sq m. The magnitude of this flux suggests that atmospheric heat transport plays a significant role in the destruction of ice in the Antarctic MIZ. Using the rising of the inversion and ABL similarity theory, we estimated the neutral stability drag coefficient across the MIZ increased from its open ocean value, .0012, at the ice edge to .004 at 80-90% ice concentration. We present an equation for this dependence of drag on ice concentration that should be useful for modeling the surface stress in marginal ice zones. (Auth.)

MP 1668

ANTARCTIC SEA ICE MICROWAVE SIGNATURES AND THEIR CORRELATION WITH *IN SITU* ICE OBSERVATIONS.

Comiso, J.C., et al, *Journal of geophysical research,* Jan. 20, 1984, 89(C1), p.662-672, 24 refs.

Ackley, S.F., Gordon, A.L.

38-1820

SEA ICE DISTRIBUTION, MICROWAVES, REMOTE SENSING, SPACEBORNE PHOTOGRAPHY, ANTARCTICA—WEDDELL SEA.

The general characteristics and microwave radiative properties of sea ice in the Weddell Sea region during the onset of spring are studied by using the NIMBUS 7 Scanning Multichannel Microwave Radiometer (SMMR) and other satellite sensors in conjunction with *in situ* observations. The position of the ice edge, the gradient of ice concentration, and the width of the Marginal Ice Zone are inferred from the microwave data and are found to be consistent with ship observations especially at 18 GHz. The sensitivities of the various SMMR frequencies to surface and other effects are investigated by using multi-spectral cluster analysis. The results show considerable variability in emissivity, especially at 37 GHz, likely associated with varying degrees of surface wetness. Ice concentrations are derived by using two methods: one that assumes fixed emissivities for consolidated ice and an iterative procedure that accounts for the variable emissivities observed. Use of the procedure that allows the emissivities to be variable gives ice concentrations that are more consistent with qualitative field observations. (Auth.)

MP 1669

POSSIBILITY OF ANOMALOUS RELAXATION DUE TO THE CHARGED DISLOCATION PROCESS.

Itagaki, K., *Journal of physical chemistry,* Oct. 13, 1983, 87(21), p.4261-4264, 12 refs.

38-1613

ICE PHYSICS, ICE ELECTRICAL PROPERTIES, ICE RELAXATION, CHARGE TRANSFER, ELECTRIC CHARGE, DIELECTRIC PROPERTIES, SPECTRA.

The possible contribution of electrically charged dislocations to dielectric relaxation and the consequent effects were examined and compared with experimental results. A catastrophe caused by the positive feedback was found to be possible under normally attainable conditions.

MP 1670

EFFECT OF X-RAY IRRADIATION ON INTERNAL FRICTION AND DIELECTRIC RELAXATION OF ICE.

Itagaki, K., et al, *Journal of physical chemistry,* Oct. 13, 1983, 87(21), p.4314-4317, 5 refs.

Ackley, S.F., VanDevender, J.P.

38-1623

ICE PHYSICS, ICE ELECTRICAL PROPERTIES, ICE RELAXATION, INTERNAL FRICTION, X RAY DIFFRACTION, DIELECTRIC PROPERTIES, RADIATION.

Studies of X-ray irradiation effects on dielectric relaxation and internal friction of ice indicated that relaxation times were shortened in both cases, but the corresponding quantities (the imaginary part of the dielectric constant and loss tangent in internal friction) behave differently. Of the two mechanisms discussed in an attempt to explain the results, a charged dislocation process seems to provide the better fit.

MP 1671

EFFECT OF STRESS APPLICATION RATE ON THE CREEP BEHAVIOR OF POLYCRYSTALLINE ICE.

Cole, D.M., *Journal of energy resources technology,* Dec. 1983, 105(4), p.454-459, 14 refs.

38-2084

ICE CREEP, STRESSES, STRAINS, LOADS (FORCES), TEMPERATURE EFFECTS, ICE ACOUSTICS, RHEOLOGY, TESTS.

This work examines the effect of the rate of stress application on the creep behavior of polycrystalline ice. Stress rates from 1/1000 to 1.84 MPa/s were used to achieve a creep stress of 3.6 MPa at test temperatures of -5 and -10C. The treatment emphasizes the effect of stress application rate on primary behavior and the accompanying microfracturing activity. Acoustic emission measurements taken in all tests indicate the onset and rate peak of the microfracturing activity. The stress application rate has little effect on the minimum strain rate, the strain at which it occurs, or the characteristics of tertiary creep provided that the loading ramp ends prior to reaching the nominal failure strain of 1.0 percent. Primary creep behavior is significantly affected only at rates below about 1/100 MPa/s. Results indicate that when the loading ramp continues through the failure strain, no minimum strain rate occurs, but rather the strain rate increases monotonically throughout the entire test.

MP 1672

IMPLICATIONS OF SURFACE ENERGY IN ICE ADHESION.

Itagaki, K., *Journal of adhesion,* 1983, 16(1), p.41-48, 2 refs.

38-2090

ICE ADHESION, ICE SOLID INTERFACE, SURFACE PROPERTIES, ICE STRENGTH, STRESSES, COATINGS.

MP 1673

MARGINAL ICE ZONES: A DESCRIPTION OF AIR-ICE-OCEAN INTERACTIVE PROCESSES, MODELS AND PLANNED EXPERIMENTS.

Johannessen, O.M., et al, Arctic technology and policy. Edited by I. Dyer and C. Chryssostomidis, Washington, D.C., Hemisphere Publishing Co., 1984, p.133-146, Refs. p.139-140.

Hibler, W.D., III, Wadhams, P., Campbell, W.J., Hasselmann, K., Dyer, I.

38-1994

ICE CONDITIONS, ICE EDGE, ICE WATER INTERFACE, ICE AIR INTERFACE, ICE NAVIGATION, ICE MECHANICS, OCEANOGRAPHY, METEOROLOGY, AIR WATER INTERACTIONS, CLIMATE, ICE ACOUSTICS.

The marginal ice zones (MIZ) are regions where temperate and polar climate systems interact, resulting in strong horizontal and vertical gradients in the atmosphere and the ocean. These gradients lead to mesoscale processes which affect the heat, salt, and momentum fluxes at the ice margin. It is therefore important to increase our understanding of these processes in order to model the air-ice-ocean system in the MIZ, and to build up a predictive capability of the ice margin. Parameterization of these processes is also necessary in large scale modeling of the sea ice influence on the global climate system. This paper reviews our knowledge of physical processes occurring in the marginal ice zones, points out problem areas and describes Marginal Ice Zone Program (MIZEX) to be initiated in 1983.

MP 1674

MECHANICAL PROPERTIES OF ICE IN THE ARCTIC SEAS.

Weeks, W.F., et al, Arctic technology and policy. Edited by I. Dyer and C. Chryssostomidis, Washington, D.C., Hemisphere Publishing Co., 1984, p.235-259, 109 refs.

Mellor, M.

38-1999

ICE MECHANICS, SEA ICE, ICE LOADS, ICEBERGS, ICE ISLANDS, ICE STRENGTH, STRESS STRAIN DIAGRAMS, ICE STRUCTURE, ICE COMPOSITION, SCANNING ELECTRON MICROSCOPY, ARCTIC OCEAN.

The mechanical properties are reviewed for the main types of ice in arctic seas (glacial (icebergs), shelf (ice islands), sea ice) and representative values are given. Each ice type possesses a characteristic range of structures and compositions that differentiate it from other varieties of ice and to a considerable extent, these produce large variations in mechanical properties. Factors affecting mechanical properties (temperature, brine and gas volume, crystal orientation and size, strain rate) are discussed, as are gaps, contradictions, and inadequacies in available data.

MP 1675

PROCEEDINGS.

International Offshore Mechanics and Arctic Engineering Symposium, 3rd, New Orleans, Louisiana, Feb. 12-17, 1984, New York, NY, American Society of Mechanical Engineers, 1984, 3 vols., Refs. passim. For selected papers see from Vol.1: 38-2979; from Vol.2: 38-2980; from Vol.3: 38-2017 through 38-2068.

Lunardini, V.J., ed.

38-2016

PERMAFROST PHYSICS, FROZEN GROUND PHYSICS, SEA ICE, FROST HEAVE, ICE CONDITIONS, OFFSHORE STRUCTURES, ICE SOLID INTERFACE, HEAT TRANSFER, ENGINEERING, STEEL STRUCTURES.

MP 1676

DETERIORATION OF FLOATING ICE COVERS.

Ashton, G.D., International Offshore Mechanics and Arctic Engineering Symposium, 3rd, New Orleans, Louisiana, Feb. 12-17, 1984. Proceedings, Vol.3. Edited by V.J. Lunardini, New York, American Society of Mechanical Engineers, 1984, p.26-33, 18 refs.

38-2020

ICE DETERIORATION, FLOATING ICE, HEAT TRANSFER, ICE MELTING, ICE COVER STRENGTH, SOLAR RADIATION, ALBEDO, THERMAL REGIME.

The deterioration of floating ice covers is analyzed to determine under what conditions the ice cover loses strength due to internal melting. The analysis considers the interaction between sensible heat transfer and long wave radiation loss at the surface, the surface albedo, the short wave radiation penetration and absorption and the unsteady heat conduction within the ice. The thermal analysis then leads to a determination of the porosity of the ice that allows strength analysis to be made using beam-type analyses. The results provide criteria to determine when and how rapidly the ice cover loses strength and under what conditions it will regain the original strength associated with an ice cover of full integrity.

MP 1677

PERFORMANCE OF A THERMOSYPHON WITH AN INCLINED EVAPORATOR AND VERTICAL CONDENSER.

Zarling, J.P., et al, International Offshore Mechanics and Arctic Engineering Symposium, 3rd, New Orleans, Louisiana, Feb. 12-17, 1984. Proceedings, Vol.3. Edited by V.J. Lunardini, New York, American Society of Mechanical Engineers, 1984, p.64-68, 15 refs.

Haynes, F.D.

38-2026

COOLING, SOIL STABILIZATION, PIPELINE SUPPORTS, EQUIPMENT, THERMOSYPHONS, AIR TEMPERATURE, WIND VELOCITY.

Thermosyphons are presently being installed at inclined angles for various subgrade cooling applications in the Arctic. However, the thermal performance characteristics of a thermosyphon installed at these inclined angles is unknown. The performance of a standard CO2 filled, two phase thermosyphon was determined experimentally. Heat removal effectivenesses were measured over a wide range of inclined angles from the horizontal. Empirical expressions were obtained for the heat removal rates as a function of wind speed and ambient air temperature.

MP 1678

TWO-DIMENSIONAL MODEL OF COUPLED HEAT AND MOISTURE TRANSPORT IN FROST HEAVING SOILS.

Guymon, G.L., et al, International Offshore Mechanics and Arctic Engineering Symposium, 3rd, New Orleans, Louisiana, Feb. 12-17, 1984. Proceedings, Vol.3. Edited by V.J. Lunardini, New York, American Society of Mechanical Engineers, 1984, p.91-98, 30 refs.

Hromadka, T.V., II, Berg, R.L.

38-2030

FROST HEAVE, FROZEN GROUND PHYSICS, HEAT TRANSFER, GROUND ICE, MOISTURE TRANSFER, SOIL WATER MIGRATION, MATHEMATICAL MODELS, FREEZE THAW CYCLES, EMBANKMENTS, WATER PRESSURE, TEMPERATURE EFFECTS.

A two-dimensional model of coupled heat and moisture flow in frost-heaving soils is developed based upon well known equations of heat and moisture flow in soils. Numerical solution is by the nodal domain integration method which includes the integrated finite difference and the Galerkin finite element methods. Solution of the phase change process is approximated by an isothermal approach and phenomenological equations are assumed for processes occurring in freezing or thawing zones. The model has been verified against experimental one-dimensional freezing soil column data and experimental two-dimensional soil thawing tank data as well as two-dimensional soil seepage data. The model has been applied to several simple but useful field problems such as roadway embankment freezing and frost heaving.

MP 1679

SUMMARY OF THE STRENGTH AND MODULUS OF ICE SAMPLES FROM MULTI-YEAR PRESSURE RIDGES.

Cox, G.F.N., et al, International Offshore Mechanics and Arctic Engineering Symposium, 3rd, New Orleans, Louisiana, Feb. 12-17, 1984. Proceedings, Vol.3. Edited by V.J. Lunardini, New York, American Society of Mechanical Engineers, 1984, p.126-133, 14 refs.

Richter, J.A., Weeks, W.F., Mellor, M.

38-2035

PRESSURE RIDGES, ICE STRENGTH, COMPRESSIVE PROPERTIES, TEMPERATURE EFFECTS, STRAIN TESTS, ICE SAMPLING, MEASURING INSTRUMENTS, POROSITY, BEAUFORT SEA.

Over two hundred unconfined compression tests were performed on vertical ice samples obtained from ten multi-year pressure ridges in the Beaufort Sea. The tests were performed on a closed-loop electrohydraulic testing machine at two strain rates (1/100,000 and 1/1000/s) and two temperatures (-20 and -5C). This paper summarizes the sample preparation and testing techniques used in the investigation and presents data on the compressive strength and initial tangent modulus of the ice.

MP 1680

VARIATION OF ICE STRENGTH WITHIN AND BETWEEN MULTIYEAR PRESSURE RIDGES IN THE BEAUFORT SEA.

Weeks, W.F., International Offshore Mechanics and Arctic Engineering Symposium, 3rd, New Orleans, Louisiana, Feb. 12-17, 1984. Proceedings, Vol.3. Edited by V.J. Lunardini, New York, American Society of Mechanical Engineers, 1984, p.134-139, 6 refs.

38-2036

ICE STRENGTH, PRESSURE RIDGES, COMPRESSIVE PROPERTIES, ICE STRUCTURE, ICE COVER STRENGTH, STRAINS, TEMPERATURE EFFECTS, POROSITY, SEA ICE, BEAUFORT SEA.

A recent series of tests on the uniaxial compressive strength of ice samples taken from multiyear pressure ridges allows the testing of several hypotheses concerning the variation in strength within and between ridges. The data set consists of 218 strength tests performed at two temperatures (-5 and -20C) and two strain rates (1/1000 and 1/100,000/s). There was no significant difference between the strength of the ice from the ridge sails and the ice from the ridge keels when tested under identical conditions. As the total porosity of the ice from the sails is higher by 40% than the ice from the keels, the lack of a significant difference is believed to result from the large variations in the structure of the ice which occur randomly throughout the cores. A three-level analysis of variance model was used to study the variations in strength between 10 different ridges, between cores located side by side in a given ridge, and between samples from the same core. In all cases the main factor contributing to the observed variance was the differences within cores. This is not surprising considering the rather extreme local variability in the structure of ice in such ridges. There was no reason at the 5% level of significance to doubt the hypothesis that the different cores at the same site and the different ridges have equal strength means.

MP 1681

RELATIONSHIP BETWEEN CREEP AND STRENGTH BEHAVIOR OF ICE AT FAILURE.

Cole, D.M., *Cold regions science and technology,* Oct. 1983, 8(2), p.189-197, 4 refs.

38-1513

ICE STRENGTH, ICE CREEP, ICE MECHANICS, STRESSES, STRAINS.

This work explores the correspondence between the results of creep and strength tests performed on isotropic polycrystalline ice. A unique experimental procedure, termed a two-mode test in the present work, allows the testing of a single specimen under conditions of constant deformation rate up to failure and constant load thereafter. Using this procedure, the prevailing values of stress, strain and strain rate can be compared at the failure point under the two test modes without the influence of specimen variation. The effect of the stress path prior to failure on the creep behavior after failure can also be investigated. Results indicate coincidence of the failure points from creep and strength tests in stress/strain-rate/strain space. Furthermore, it appears that within the range of variables tested, the creep behavior after the mode switch at failure is independent of the stress path experienced before failure. (Auth.)

MP 1682

COMPARISON OF U.S.S.R. CODES AND U.S. ARMY MANUAL FOR DESIGN OF FOUNDATIONS ON PERMAFROST.

Fish, A.M., *Cold regions science and technology,* Aug. 1983, 8(1), p.3-24, 27 refs.

38-1495

PERMAFROST BENEATH STRUCTURES, FOUNDATIONS, BUILDING CODES, SOIL CLASSIFICATION, SETTLEMENT (STRUCTURAL), SOIL CREEP, SAFETY.

A comparative study was made of design criteria and analytical methods for footings and pile foundations on permafrost employed in U.S.S.R. Design Code SNiP II-8-76 (1977) and U.S. Army CRREL SR 80-34 developed in the early 1970s by the U.S. Army Corps of Engineers and published in 1980. The absence of adequate constitutive equations for frozen soils and of rigorous solutions of the boundary problems has made it necessary to incorporate (explicitly or implicitly) various safety factors in the foundation analyses. From the review it is concluded that the principal difference between these practices is in the assessment and application of appropriate values of safety factors, which leads to a substantial discrepancy in the dimensions and costs of footings and pile foundations in permafrost. (Auth.)

MP 1683

STRAIN MEASUREMENTS ON DUMBBELL SPECIMENS.

Mellor, M., *Cold regions science and technology,* Aug. 1983, 8(1), p.75-77, 3 refs.

38-1501

STRAIN TESTS, TENSILE PROPERTIES.

MP 1684

LAKE ICE DECAY.

Ashton, G.D., *Cold regions science and technology,* Aug. 1983, 8(1), p.83-86, 4 refs.

38-1503

LAKE ICE, ICE COVER THICKNESS, ICE MELTING.

MP 1685

PRELIMINARY EXAMINATION OF THE EFFECT OF STRUCTURE ON THE COMPRESSIVE STRENGTH OF ICE SAMPLES FROM MULTI-YEAR PRESSURE RIDGES.

Richter, J.A., et al, International Offshore Mechanics and Arctic Engineering Symposium, 3rd, New Orleans, Louisiana, Feb. 12-17, 1984. Proceedings, Vol.3. Edited by V.J. Lunardini, New York, American Society of Mechanical Engineers, 1984, p.140-144, 9 refs.

Cox, G.F.N.

38-2037

ICE STRENGTH, PRESSURE RIDGES, COMPRESSIVE PROPERTIES, STRAIN TESTS, ICE STRUCTURE, TEMPERATURE EFFECTS, SEA ICE, LOADS (FORCES), POROSITY.

A series of 222 uniaxial constant-strain-rate compression tests were performed on vertical multi-year pressure ridge sea ice samples. A preliminary analysis of the effect of structure on the compressive strength of the ice was performed on 78 of these tests. Test parameters included a temperature of -5C (23F) and strain rates of 1/100,000 and 1/1000/s. Columnar ice loaded parallel to the elongated crystal axes and perpendicular to the crystal c-axis was consistently the strongest type of ice. The strength of the columnar samples decreased significantly as the orientation of the elongated crystals approached the plane of maximum shear. Samples containing granular ice or a mixture of granular and columnar ice resulted in intermediate and low strength values. No clear relationship could be established between structure and strength for these ice types. However, in general, their strength decreased with an increase in porosity.

MP 1686

INFLUENCE OF GRAIN SIZE ON THE DUCTILITY OF ICE.

Cole, D.M., International Offshore Mechanics and Arctic Engineering Symposium, 3rd, New Orleans, Louisiana, Feb. 12-17, 1984. Proceedings, Vol.3. Edited by V.J. Lunardini, New York, American Society of Mechanical Engineers, 1984, p.150-157, 21 refs.

38-2039

ICE CRACKS, ICE CREEP, ICE STRENGTH, GRAIN SIZE, POROSITY, COMPRESSIVE PROPBRTIES, ICE CRYSTAL STRUCTURE, LOADS (FORCES), BRITTLENESS, TESTS.

This paper presents observations made regarding the influence of grain size on the extent of internal cracking and creep behavior of polycrystalline ice. The test material was initially isotropic, laboratory prepared polycrystalline ice. Grain size ranged from 1.52 to 5.65 mm. Specimens were tested under constant load in uniaxial compression with an initial stress of 2MPa and at a temperature of -5C. Optical post-test analysis showed that the estimated crack density varied over nearly three orders of magnitude as the grain size increased by a factor of three. The smallest-grained specimen exhibited no visible fractures. The strain at the minimum creep rate decreased significantly as the grain size, and hence the fracturing activity increased. These observations indicate that under the prevailing test conditions, the stated variations in grain size alone can initiate the ductile-to-brittle transition. Discussion centers on a micro-mechanical explanation of the test results as well as the implications of the findings to areas of practical concern.

MP 1687

EXPERIMENTAL DETERMINATION OF BUCKLING LOADS OF CRACKED ICE SHEETS.

Sodhi, D.S., et al, International Offshore Mechanics and Arctic Engineering Symposium, 3rd, New Orleans, Louisiana, Feb. 12-17, 1984. Proceedings, Vol.3. Edited by V.J. Lunardini, New York, American Society of Mechanical Engineers, 1984, p.183-186, 13 refs.

Adley, M.D.

38-2044

FLOATING ICE, ICE CRACKS, ICE SHEETS, LOADS (FORCES), ICE SOLID INTERFACE, ICE LOADS, ICE DEFORMATION, EXPERIMENTATION.

An experimental study was undertaken to determine the buckling loads of cracked, floating ice sheets. The configurations of the cracks considered in this study were symmetrical and unsymmetrical with respect to the structure and the direction of loading. The results of this study are compared with those of a theoretical study using a finite element method. The comparison between the two results is good although there is some scatter in the experimental data.

MP 1688

SNOW PARTICLE MORPHOLOGY IN THE SEASONAL SNOW COVER.

Colbeck, S.C., *American Meteorological Society. Bulletin,* June 1983, 64(6), p.602-609, 14 refs.

38-2095

SNOWFLAKES, SNOW MORPHOLOGY, SNOW CRYSTAL STRUCTURE, SNOW WATER CONTENT, SNOW COVER, FREEZE THAW CYCLES, PARTICLES, DEPTH HOAR, METEOROLOGICAL FACTORS.

Snow precipitation degenerates rapidly once it reaches the ground. A wide variety of particle types develop in seasonal snow covers, thus leading to a wide range of snow properties. The most common varieties of particles are shown here. The physical processes responsible for the growth and development of these particles are described in general terms, althouth these processes are not understood as well as the processes of crystal growth in the atmosphere. The heat and mass flows associated with the development of these crystals in the snow cover are complicated because of snow's complex geometry.

MP 1689

USE OF RADIO FREQUENCY SENSOR FOR SNOW/SOIL MOISTURE WATER CONTENT MEASUREMENT.

McKim, H.L., et al, *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* Aug. 1983, SR 83-31, Snow symposium, 3rd, Hanover, NH, Aug. 9-10, 1983. Proceedings, Vol.1, p.33-42, ADB-079 265, 16 refs.

Pangburn, T., Walsh, J.E.

38-2122

SNOW WATER CONTENT, SOIL WATER, SNOW ELECTRICAL PROPERTIES, SOIL PHYSICS, UNFROZEN WATER CONTENT, MEASURING INSTRUMENTS, DIELECTRIC PROPERTIES, TESTS, TEMPERATURE EFFECTS.

A solid-state, durable, inexpensive radio frequency sensor (RFS) has been developed and laboratory-tested. The RFS uses a Wien bridge circuit to measure a change in soil impedance when changes in soil moisture occur. Both electrical conductance and capacitance are measured at differing moisture contents. The dielectric constant of the soil moisture is proportional to the measured capacitance and is approximately linear with respect to percent moisture. Due to the simple readout system, the RFS has the potential to be interfaced to a data collection system for data acquisition from remote areas. Preliminary tests on the temperature effect of the RFS accuracy have shown that volumetric water content can be obtained by the RFS over a wide range of temperatures. In addition to the soil moisture measurement, preliminary tests on the measurement of the liquid water-content of snow have been made. Comparison of the results with the calorimetric method indicate that the RF sensor can be used to measure snow water content. Since the RFS is solid state, it can be placed in remote areas and can monitor volumetric soil water content to within 0.5% by volume.

MP 1690

COMPARATIVE NEAR-MILLIMETER WAVE PROPAGATION PROPERTIES OF SNOW OR RAIN.

Nemarich, J., et al, *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* Aug. 1983, SR 83-31, Snow symposium, 3rd, Hanover, NH, Aug. 9-10, 1983. Proceedings, Vol.1, p.115-129, ADB-079 265, 8 refs.

Wellman, R.J., Gordon, B.E., Hutchins, D.R., McDaniel, J., Lacombe, J., Olsen, R.O.

38-2129

SNOW PHYSICS, SNOW ACOUSTICS, SNOWFALL, WAVE PROPAGATION, ATTENUATION, BACKSCATTERING, RAIN, SNOW WATER CONTENT, ELECTROMAGNETIC PROPERTIES, SNOWFLAKES, FALLING BODIES, MODELS.

Measurements are reported of attenuation and backscatter for rain and falling snow at near-millimeter wave frequencies of 96, 140, and 225 GHz. Comparisons are made between levels and frequency dependences of the attenuations for rain and snow. Backscatter coefficients as a function of time for several rain and snow events are presented. The relationship of the attenuation data obtained to calculations for spherical and spheroidal particles is discussed. It is shown that attenuation values calculated for an empirical distribution of ice spheres agree with measured values over a wavelength range from visible to 3.1 mm.

MP 1691

HYDROLOGIC FORECASTING USING LANDSAT DATA.

Merry, C.J., et al, *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* Aug. 1983, SR 83-31, Snow symposium, 3rd, Hanover, NH, Aug. 9-10, 1983. Proceedings, Vol.1, p.159-168, ADB-079 265, 12 refs.

Pangburn, T., McKim, H.L.

38-2132

SNOW WATER EQUIVALENT, REMOTE SENSING, HYDROLOGY, FORECASTING, LANDSAT, SNOW DEPTH.

Measurements of snow depth and its water equivalent were obtained at 11 snow courses in the Allagash, Maine, area in conjunction with acquisition of five Landsat-2 and -3 images during the 1977-78 and 1978-79 winters. Digital imagery data acquired on 31 May 1978, when the land was snow-free, was used to classify land cover categories. Ground truth water equivalent measurements of snow were area-weighted using the land cover classification to derive regional mean water equivalent values for snow cover on each of the five Landsat scenes. The 1 March 1978 snow measurement of 19.46 cm of water equivalent was used as an input value to the SSARR (Streamflow Synthesis and Reservoir Regulation) model. The SSARR prediction for the 1 March-31 May 1978 time period was within 78% of the measured runoff for the initial baseflow period and within 67% for the spring melt recession period. However, the timing of six observed runoff peaks was off by 2 to 9 days. The magnitude of five of the predicted runoff peaks was within 75% of the recorded streamflow. Additional work on calibrating the basin peak timing and melt rate factors is underway.

MP 1692

UTILIZATION OF THE SNOW FIELD TEST SERIES RESULTS FOR DEVELOPMENT OF A SNOW OBSCURATION PRIMER.

Ebersole, J.F., et al, *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* Aug. 1983, SR 83-31, Snow symposium, 3rd, Hanover, NH, Aug. 9-10, 1983. Proceedings, Vol.1, p.209-217, ADB-079 265, 21 refs.

Aitken, G.W.

38-2137

SNOW OPTICS, ATTENUATION, SNOWFALL, BLOWING SNOW, SNOW DENSITY, ICE CRYSTAL STRUCTURE, WAVE PROPAGATION, VISIBILITY, MILITARY OPERATION, NAVIGATION, SNOWDRIFTS, METEOROLOGICAL FACTORS.

The attenuation of electro-optical (EO), infrared (IR), and millimeter wave (MMW) energy through the atmosphere in conditions of low visibility due to the presence of falling or blowing snow can present serious problems for the effective use of surveillance and target acquisition systems. This paper discusses development of a snow obscuration primer for use by the Smoke and Aerosol Working Group (SAWG) of the Joint Technical Coordinating Group for Munitions Effectiveness (JTCG/ME). A key part of this primer is incorporation of test results obtained in the SNOW-ONE, -ONE-A, and -ONE-B field trials. This includes measurements of falling and blowing snow obscuration effects on EO/IR/MMW systems, both active and passive. An important aspect of this work, reported in this paper, is the evolution of a basis for developing "rules-of-thumb" for operation in air-borne-snow environments.

MP 1693

INCREASED HEAT FLOW DUE TO SNOW COMPACTION: THE SIMPLISTIC APPROACH.

Colbeck, S.C., *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* Aug. 1983, SR 83-31, Snow symposium, 3rd, Hanover, NH, Aug. 9-10, 1983. Proceedings, Vol.1, p.227-229, ADB-079 265, Extended summary. 2 refs.

38-2138

SNOW COMPACTION, HEAT TRANSFER, SNOW HEAT FLUX, SNOW COVER STRUCTURE, SURFACE TEMPERATURE, MATHEMATICAL MODELS.

When snow is compacted by foot or vehicle traffic, the compacted areas are visible on infrared images for some time. A simple model is used to calculate the temperature difference between the compacted and uncompacted snows. The results are given as temperature difference versus snow compaction.

MP 1694

USE OF LANDSAT DATA FOR PREDICTING SNOWMELT RUNOFF IN THE UPPER SAINT JOHN RIVER BASIN.

Merry, C.J., et al, International Symposium on Remote Sensing of Environment, 17th, Ann Arbor, MI, May 9-13, 1983. Proceedings, Ann Arbor, Environmental Research Institute of Michigan, 1983, p.519-533, 16 refs.

Miller, M.S., Pangburn, T.

38-2166

RUNOFF FORECASTING, SNOWMELT, REMOTE SENSING, SNOW WATER EQUIVALENT, SNOW DEPTH, LANDSAT, REFLECTIVITY, FOREST LAND, MODELS, VEGETATION FACTORS, UNITED STATES—MAINE—ST. JOHN RIVER.

To test a hypothesis that Landsat reflected radiance values on a regional scale do change, histograms of the Landsat MSS band 7 reflected radiance values for a 300 x 300 pixel (420 sq km) area near Allagash, Maine, were evaluated to quantify the change. A statistical description (skewness and kurtosis) of the histogram for each scene was developed and then correlated with ground measurements of snow depth. A snow index based on skewness and modal population was found to correlate well with snow depth. Following these initial results, the Landsat data were reexamined and corrections were made for solar elevation and MSS sensor calibration. The reflected radiance from open areas showed a consistent increase in intensity with increasing snow depth. The forested land cover classes did not change with snow depth. The ground truth measurements of water equivalent were area-weighted by the May land cover classification to derive mean regional water equivalent values for each of the five Landsat winter scenes. The 1 March 1978 estimate of 7.66 inches for snow water equivalent was used as input to the SSARR model for prediction of runoff during the 1 March through 31 May 1978 time period.

MP 1695

EXTRACTION OF TOPOGRAPHY FROM SIDE-LOOKING SATELLITE SYSTEMS—A CASE STUDY WITH SPOT SIMULATION DATA.

Ungar, S.G., et al, International Symposium on Remote Sensing of Environment, 17th, Ann Arbor, MI, May 9-13, 1983. Proceedings, Ann Arbor, Environmental Research Institute of Michigan, 1983, p.535-550, 3 refs.

Irish, R., Merry, C.J., Strahler, A.H., McKim, H.L., Gauthier, B., Weill, G., Miller, M.S.

38-2167

TOPOGRAPHIC FEATURES, SIDE LOOKING RADAR, REMOTE SENSING, RADIOMETRY, COMPUTER APPLICATIONS, MAPPING.

A test site in the Cape Flattery area of northwest Washington state was selected for constructing a simulated data set to evaluate techniques for extracting topography from side-looking satellite systems. A negative transparency orthophotoquad was digitized at a spacing of 85 micron, resulting in an equivalent ground distance of 9.86 m between pixels and a radiometric resolution of 256 levels. A bilinear interpolation was performed on U.S. Geological Survey digital elevation model (DEM) data to generate elevation data at a 9.86 m resolution. The nominal orbital characteristics and geometry of the SPOT (Système Probatoire d'Observation de la Terre) satellite were convoluted with the data files to produce simulated panchromatic HRV (High Resolution Visible) digital stereo imagery for three different orbital paths. Techniques were developed for reconstructing topographic data. Essentially, these techniques coalign a nadir and off-nadir pass to calculate the stereo displacement for each pixel in the nadir view by correlating a small subarea to a corresponding subarea in the off-nadir pass. Preliminary analyses with the simulated HRV data and "test pattern" data verify the efficacy of this technique.

MP 1696

LIME STABILIZATION AND LAND DISPOSAL OF COLD REGION WASTEWATER LAGOON SLUDGE.

Schneiter, R.W., et al, *Environment international,* 1982, 7(3), p.207-213, 30 refs.

Middlebrooks, E.J., Sletten, R.S.

38-2244

WASTE TREATMENT, WATER TREATMENT, LIMING, SLUDGES, RECLAMATION.

Effects of lime ₍Ca(OH)2₎ stabilization upon the pathogenic population in accumulated solids associated with the operation of two aerated wastewater lagoons in Alaska and two facultative wastewater lagoons in northern Utah were evaluated. The subsequent drying, at a temperature of 12C, of the lime stabilized sludges on sand and soil beds was also investigated. The lime stabilization of the lagoon sludges was evaluated by dosing the sludges with lime and applying sludges to bench scale drying beds. Lime addition produced high fecal coliform reduction, and the limed sludges readily dewatered on both sand and soil beds.

MP 1697

CALCULATION OF ADVECTIVE MASS TRANSPORT IN HETEROGENEOUS MEDIA.

Daly, C.J., U.S. Army Research Office, Report No.83-1, Conference of Army Mathematicians, 28th, ₍1983₎. Transactions, ₍1983₎, p.73-89, 12 refs.

38-2506

POROUS MATERIALS, MASS TRANSFER, GROUND WATER, FLUID DYNAMICS, ANALYSIS (MATHEMATICS).

A coupled analytical/numerical procedure for prediction of solute transport in heterogeneous media is described. The procedure consists of an analytic solution of the hydraulic equations, followed by a numerical solution for solute transport using the method of characteristics. The characteristics are determined by fourth-order Runge-Kutta and predictor-corrector algorithms. Accuracy of solute transport calculation is enhanced by the fact that fluid velocity can be directly obtained at a priori undetermined points in the flow field. The solute transport process is considered to be entirely advective, neglecting the effects of mechanical dispersion and molecular diffusion. Evidence is presented to demonstrate that purely advective processes in both heterogeneous and homogeneous media can produce large "apparent dispersion." Such dispersion is shown to be easily capable of overwhelming any reasonable estimates of dispersion or diffusion based upon laboratory analyses of homogeneous media. For groundwater contamination problems, it is concluded that precise definition of the spatial variability of hydraulic properties is crucial to the accurate determination of the trajectory of contaminated waters.

MP 1698

CHARACTERISTICS OF MULTI-YEAR PRESSURE RIDGES.

Kovacs, A., International Conference on Port and Ocean Engineering under Arctic Conditions, 7th, Helsinki, Finland, April 5-9, 1983. Proceedings, Vol.3, Espoo, Valtion teknillinen tutkimuskeskus, 1983, p.173-182, 13 refs.

38-2727

PRESSURE RIDGES, ICE FLOES, ICE FORMATION, OFFSHORE STRUCTURES, ICE PRESSURE, ICE STRENGTH, HUMMOCKS, COMPRESSIVE PROPERTIES, SEA ICE.

Multi-year pressure ridges and thick hummock floes are the most severe ice formations that offshore structures will probably have to resist in the Beaufort and Chukchi Seas. Multi-year hummock fields 30 m thick have been measured near Prudhoe Bay, Alaska. This paper presents information on 11 multi-year pressure ridges. The ridges were found to be voidless, and contained ice with a mean brine-free density of about 0.84 mg/cu m. The apparent unconfined compressive strength was about 7 to 8 MPa at -10 C. The strength increased with depth below sea level, and, as expected, varied inversely with ice porosity. The sail-height-to-keel-depth ratios of these ridges are compared with observations made in the Beaufort and Chukchi Seas to show that the multi-year ridges in these areas have a relatively constant sail-height-to-keel-depth ratio of about 1 to 3.3.

MP 1699

SEA ICE ON THE NORTON SOUND AND ADJACENT BERING SEA COAST.

Kovacs, A., International Conference on Port and Ocean Engineering under Arctic Conditions, 7th, Helsinki, Finland, April 5-9, 1983. Proceedings, Vol.4, Espoo, Valtion teknillinen tutkimuskeskus, 1983, p.654-666, 17 refs.

38-2757

ICE MECHANICS, SEA ICE DISTRIBUTION, ICE OVERRIDE, ICE PILEUP, SHORES, OFFSHORE STRUCTURES.

Recent observations and historical accounts of sea ice on the shores of Norton Sound and the adjacent Bering Sea are presented. The movement and accumulation of sea ice on the shore was found to be a common event, as were massive icings on island surfaces. Sea ice was found to have been pushed inland over 150 m and to have moved over 15 km inland during high storm seas.

MP 1700

OCEAN CIRCULATION: ITS EFFECT ON SEASONAL SEA-ICE SIMULATIONS.

Hibler, W.D., III, et al, *Science*, May 4, 1984, 224(4648), p.489-492, 13 refs.
Bryan, K.
38-2846
SEA ICE, SEASONAL VARIATIONS, ICE WATER INTERFACE, ICE EDGE, MODELS, ENVIRONMENT SIMULATION, OCEAN CURRENTS.

A diagnostic ice-ocean model of the Arctic, Greenland, and Norwegian seas is constructed and used to examine the role of ocean circulation in seasonal sea-ice simulations. The model includes lateral ice motion and three-dimensional ocean circulation. The ocean portion of the model is weakly forced by observed temperature and salinity data. Simulation results show that including modeled ocean circulation in seasonal sea-ice simulations substantially improves the predicted ice drift and ice margin location. Simulations that do not include lateral ocean movement predict a much less realistic ice edge.

MP 1701

SEA ICE STRUCTURE AND BIOLOGICAL ACTIVITY IN THE ANTARCTIC MARGINAL ICE ZONE.

Clarke, D.B., et al, *Journal of geophysical research*, Mar. 20, 1984, 89(C2), p.2087-2095, 30 refs.
Ackley, S.F.
38-2917
SEA ICE, ICE CORES, ICE COMPOSITION, ALGAE, CRYOBIOLOGY, FRAZIL ICE, ANTARCTICA—WEDDELL SEA.

Ice cores obtained during October-November 1981 from Weddell Sea pack ice were analyzed for physical, chemical, and biological parameters. Frazil ice, which is associated with dynamic, turbulent conditions in the water column, predominated (70%). Both floe thickness and salinity indicate ice which is less than 1 year old. Chemical analyses, particularly with regard to the nutrients, revealed a complex picture. Phosphate values are cattered relative to the dilution curve. Nitrate and silicate values are lower than expected from simple scaling with salinity and suggest diatom growth within the ice. Nitrite values are higher in the ice than in adjacent waters. Frazil ice formation which probably concentrates algal cells from the water column into ice floes results in higher initial chlorophyll a by subsequent reproduction within the ice. Ice core chlorophyll ranged from 0.09 to 3.8 mg/cu m, comparable to values previously reported for this area but significantly lower than values for Antarctic coastal fast ice. The dominance of frazil ice in the Weddell is one of the major differences between this are and others. Consequently, we believe that ice structural conditions significantly influence the biological cummunities in the ice. (Auth.)

MP 1702

FIXED MESH FINITE ELEMENT SOLUTION FOR CARTESIAN TWO-DIMENSIONAL PHASE CHANGE.

O'Neill, K., *Journal of energy resources technology*, Dec. 1983, 105(4), p.436-441, 28 refs.
38-2081
FREEZE THAW CYCLES, HEAT TRANSFER, PHASE TRANSFORMATIONS, HEAT CAPACITY, TEMPERATURE EFFECTS.

MP 1703

LOW TEMPERATURE AUTOMOTIVE EMISSIONS.

Coutts, H.J., *Alaska. Department of Transportation and Public Facilities. Report*, Nov. 1983, AK-RD-84-9, 2 vols.
38-3041
COLD WEATHER OPERATION, AIR POLLUTION, ENGINES, FUELS, VEHICLES, WINTER MAINTENANCE, TESTS.

MP 1704

FROST ACTION AND ITS CONTROL.

Berg, R.L., ed, New York, American Society of Civil Engineers, 1984, 145p., Refs. passim. For individual papers see 38-3082 through 38-3085.
Wright, E.A., ed.
38-3081
FROST ACTION, FROST HEAVE, FROST RESISTANCE, SOIL FREEZING, HEAT TRANSFER, SOIL STRENGTH, PERMAFROST BENEATH STRUCTURES, ICE LENSES, DESIGN, COUNTERMEASURES, FOUNDATIONS, ROADS.

MP 1705

DESIGNING FOR FROST HEAVE CONDITIONS.

Crory, F.E., et al, Frost action and its control. Edited by R.L. Berg and E.A. Wright, New York, American Society of Civil Engineers, 1984, p.22-44, 41 refs.
Isaacs, R.M., Penner, E., Sanger, F.J., Shook, J.F.
38-3083
FROST HEAVE, HEAT TRANSFER, FROST PENETRATION, SOIL FREEZING, FOUNDATIONS, ARTIFICIAL FREEZING, ROADBEDS, UNDERGROUND PIPELINES, COLD STORAGE, PAVEMENTS, DESIGN.

MP 1706

DESIGN IMPLICATIONS OF SUBSOIL THAWING.

Johnson, T.C., et al, Frost action and its control. Edited by R.L. Berg and E.A. Wright, New York, American Society of Civil Engineers, 1984, p.45-103, 136 refs.
McRoberts, E.C., Nixon, J.F.
38-3084
GROUND THAWING, PERMAFROST BENEATH STRUCTURES, FROZEN GROUND TEMPERATURE, FREEZE THAW CYCLES, THERMAL REGIME, FROST HEAVE, DESIGN, GEOTHERMY, SHEAR STRENGTH, SETTLEMENT (STRUCTURAL), SLOPE PROTECTION, COUNTERMEASURES, SOIL STABILIZATION.

MP 1707

SURVEY OF METHODS FOR CLASSIFYING FROST SUSCEPTIBILITY.

Chamberlain, E.J., et al, Frost action and its control. Edited by R.L. Berg and E.A. Wright, New York, American Society of Civil Engineers, 1984, p.104-141, 36 refs.
Gaskin, P.N., Esch, D., Berg, R.L.
38-3085
SOIL FREEZING, FROST RESISTANCE, FROST HEAVE, SOIL STRENGTH, ROADS, AIRPORTS, CLASSIFICATIONS, GRAIN SIZE, SEASONAL FREEZE THAW.

MP 1708

DEPENDENCE OF CRUSHING SPECIFIC ENERGY ON THE ASPECT RATIO AND THE STRUCTURE VELOCITY.

Sodhi, D.S., et al, Offshore Technology Conference, 16th, Houston, Texas, May 7-9, 1984. Proceedings. Vol.1, 1984, p.363-374, 18 refs.
Morris, C.E.
38-3229
ICE PRESSURE, OFFSHORE STRUCTURES, ICE CRACKS, ICE COVER THICKNESS, ICE STRENGTH, DYNAMIC LOADS, ICE SHEET, VELOCITY, EXPERIMENTATION, COMPRESSIVE PROPERTIES, SPECIFIC HEAT, ARTIFICIAL ICE.

An experimental study was undertaken to determine the dependence of crushing specific energy of urea ice on the aspect ratio (structure diameter/ice thickness) and the structure velocity. The experiments were conducted by pushing an instrumented, vertical, cylindrical structure into ice sheets at different velocities. Two parameters were varied during the experimental program: diameter (50 to 500 mm) and velocity (10 to 210 mm/s). The urea concentration was changed slightly from 0.84 to 0.93% by weight. The results are presented graphically to show the dependence of the ratio of specific energy to unconfined uniaxial compressive strength on the aspect ratio for different ratios of velocity to ice thickness.

MP 1709

COMPARISON OF AERIAL TO ON-THE-ROOF INFRARED MOISTURE SURVEYS.

Korhonen, C., et al, International Conference on Thermal Infrared Sensing for Diagnostics and Control (Thermosense 6), Oak Brook, IL, Oct. 2-5, 1983. Proceedings, Society of Photo-Optical Instrumentation Engineers. Proceedings, Vol.446, [1983], p.95-105, 6 refs.
Tobiasson, W., Greatorex, A.
38-3274
MOISTURE DETECTION, ROOFS, INFRARED PHOTOGRAPHY, TEMPERATURE MEASUREMENT, INSULATION.

Prior research by the Corps of Engineers has shown aerial thermography to be useful as a reconnaissance tool for finding wet roof insulation. This conclusion was based on findings from thermal line scanners flown at about 1000 feet in military fixed-wing aircraft and from hand-held thermal imagers flown at about 500 feet in military helicopters. During the spring of 1983 a comprehensive aerial to on-the-roof infrared comparison study was conducted on several roofs at Fort Devens, Massachusetts. These recent studies confirm our earlier opinion that oblique thermography is generally of reconnaissance value only. However, "straight-down" thermography from either fixed-wing aircraft or from helicopters can be used to produce reasonably accurate maps of wet roof areas. The most accurate maps were produced by thermal imaging systems in a helicopter hovering as close as 200 feet above a roof. This study suggests that some forms of airborne thermography can be of more value than just a reconnaissance tool in finding wet roof insulation. Of course, a visual examination of each roof along with a few core samples are still needed before recommendations for maintenance and repair can be made.

MP 1710

POTENTIAL RESPONSES OF PERMAFROST TO CLIMATIC WARMING.

Goodwin, C.W., et al, Potential effects of carbon dioxide-induced climatic changes in Alaska; The proceedings of a conference. Edited by J.H. McBeath, Fairbanks, University of Alaska, Mar. 1984, p.92-105, 37 refs.
Brown, J., Outcalt, S.I.
38-3881
PERMAFROST DISTRIBUTION, PERMAFROST THERMAL PROPERTIES, CLIMATIC CHANGES, ACTIVE LAYER, CARBON DIOXIDE, TUNDRA, THERMOKARST DEVELOPMENT, THAW DEPTH, STEFAN PROBLEM, HEAT TRANSFER, SOIL TEMPERATURE, SNOW DEPTH.

Permafrost is generally divided into two zones from north to south: continuous and discontinuous. At its southern limit, permafrost in Alaska exists in isolated masses under peat. In the northern portion of the continuous zone, permafrost occurs everywhere near the surface of the entire landscape with the exception of deep lakes and river channels. The presumed warming of the ground in the discontinuous zone due to CO2-induced climatic change will result in an areal reduction of permafrost. In the colder areas, continuous-zone permafrost temperatures will rise and summer active-layer depths will increase, but the spatial extent of permafrost will only be marginally affected. In both cases, where there is ground ice, thermal erosion and thaw consolidation will produce thermokarst terrain.

MP 1711

MODELING RAPIDLY VARIED FLOW IN TAILWATERS.

Ferrick, M.G., et al, *Water resources research*, Feb. 1984, 20(2), p.271-289, 22 refs.
Bilmes, J., Long, S.E.
38-3317
RIVER FLOW, WAVE PROPAGATION, CHANNELS (WATERWAYS), DAMS, MATHEMATICAL MODELS, ELECTRIC POWER.

An understanding of the downstream propagation of sharp-fronted, large-amplitude waves of relatively short period is important for describing rapidly varying flows in tailwaters of hydroelectric plants and following the breach of a dam. We developed a numerical model of these waves by first identifying the primary physical processes and then performing an analysis of the solution. A linear analysis of the dynamic open channel flow equations provides relationships describing flow wave advection, diffusion, and dispersion in rivers. A one-dimensional diffusion wave model modified for application to tailwaters simulates the important physical processes and is straightforward to apply.

MP 1712

ICE-RELATED FLOOD FREQUENCY ANALYSIS: APPLICATION OF ANALYTICAL ESTIMATES.

Gerard, R., et al, International Specialty Conference on Cold Regions Engineering, 3rd, Edmonton, Alberta, April 4-6, 1984. Proceedings, [Edmonton, University of Alberta, 1984], p.85-101, 12 refs.
Calkins, D.J.
38-3470
FLOOD FORECASTING, RIVER ICE, ICE JAMS, ICE CONDITIONS, ANALYSIS (MATHEMATICS).

In cold regions ice-related floods can make a significant, and often dominant, contribution to the flood population. They should therefore be considered in a flood frequency analysis. However, in many instances, historical data for this purpose is lacking. Resort must then be made to analytical estimates of ice-related flood stages. This paper describes the determination and application of such estimates for a site on the Missisquoi River near Richford, Vermont.

MP 1713

ST. LAWRENCE RIVER FREEZE-UP FORECAST.

Shen, H.T., et al, International Specialty Conference on Cold Regions Engineering, 3rd, Edmonton, Alberta, April 4-6, 1984. Proceedings, [Edmonton, University of Alberta, 1984], p.177-190, 13 refs.
Foltyn, E.P., Daly, S.F.
38-3476
RIVER ICE, FREEZEUP, ICE FORMATION, ANALYSIS (MATHEMATICS), FORECASTING, AIR TEMPERATURE, WATER TEMPERATURE, CANADA—SAINT LAWRENCE RIVER.

An important element of the ice management in northern rivers is forecasting water temperatures to predict the time of ice formation. The freeze-up forecast provides needed information for planning flow regulations and scheduling of the close of a navigation season. In this paper, the relationship between variations of air temperature and water temperature is analyzed. An analytical expression for water temperature is obtained through the solution of a simplified convection-diffusion equation. The air temperature is represented as a combination of a harmonic function and short term fluctuations. The short term fluctuations are determined from National Weather Services forecasts.

MP 1714
WATER SUPPLY AND WASTE DISPOSAL ON PERMANENT SNOW FIELDS.
Reed, S.C., et al, International Specialty Conference on Cold Regions Engineering, 3rd, Edmonton, Alberta, April 4-6, 1984. Proceedings, [Edmonton, University of Alberta, 1984], p.401-413, 13 refs.
Bouzoun, J.R., Tobiasson, W.
38-3492
WATER SUPPLY, WASTE DISPOSAL, SNOW COVER, WATER TREATMENT, UTILITIES, SNOW MELTING, DESIGN, WATER CHEMISTRY.

This paper summarizes procedures and techniques for providing a water supply and for safe wastewater disposal at stations and camps on permanent snow fields. These range from temporary and transient field operations to large scale, permanently occupied facilities.

MP 1715
MODELING THE RESILIENT BEHAVIOR OF FROZEN SOILS USING UNFROZEN WATER CONTENT.
Cole, D.M., International Specialty Conference on Cold Regions Engineering, 3rd, Edmonton, Alberta, April 4-6, 1984. Proceedings, [Edmonton, University of Alberta, 1984], p.823-834, 14 refs.
38-3518
FROZEN GROUND MECHANICS, RHEOLOGY, UNFROZEN WATER CONTENT, ICE SOLID INTERFACE, SURFACE PROPERTIES, PARTICLES, FROZEN GROUND TEMPERATURE, ICE CRYSTAL STRUCTURE, MODELS, SALINITY.

A layer of unfrozen water exists between the soil particle surface and the solid ice phase in a frozen soil at temperatures of practical concern. This layer owes its existence to the effect of field forces associated with the soil particle surfaces. Its thickness depends on factors such as temperature, solute concentration and specific surface area. Additional unfrozen water occurs within the polycrystalline pore ice as well. The thickness of the unfrozen water layer strongly affects the mechanical behavior of the soil-ice interface and, hence, the gross mechanical properties of the frozen soil. The total unfrozen water content is particularly useful since it reflects the contributions from a number of sources to the unfrozen water layer thickness. As a consequence, the unfrozen water content provides an excellent means for temperature, salinity and specific surface area.

MP 1716
ICE RESISTANCE TESTS ON TWO MODELS OF THE WTGB ICEBREAKER.
Tatinclaux, J.C., et al, American Towing Tank Conference; General meeting, 20th, Hoboken, NJ, Aug. 2-4, 1983. Proceedings. Edited by D. Savitsky, J.F. Dalzell and M. Palazzo, [1984], p.627-638, 6 refs.
Humphreys, D.H.
38-3421
ICEBREAKERS, ICE MODELS, ICE BREAKING, ICE STRENGTH, ICE LOADS, STRENGTH, MODELS, TESTS.

MP 1717
PHYSICAL MECHANISM FOR ESTABLISHING ALGAL POPULATIONS IN FRAZIL ICE.
Garrison, D.L., et al, *Nature,* Nov. 24, 1983, 306(5941), p.363-365, 19 refs.
Ackley, S.F., Buck, K.R.
38-3424
ALGAE, FRAZIL ICE, MARINE BIOLOGY, ICE FORMATION, CRYOBIOLOGY, ANTARCTICA—WEDDELL SEA, ANTARCTICA—MCMURDO SOUND.

In polar regions ice algal communities are not only conspicuous but may also be important production sites and sources of seed populations for pelagic communities. Except for some studies near land-based stations, there are few long-term observations of ice algal populations, and few studies have considered how they form and develop. Until now, neither the mechanism for harvesting nor the effects on the composition of the ice community has been clearly demonstrated. In the Weddell Sea, we have sampled young sea ice discoloured by algae, and we present evidence that the algae were concentrated by a physical mechanism. We explain how such a process may accumulate planktonic forms in ice communities. (Auth. mod.)

MP 1718
WATER QUALITY MONITORING USING AN AIRBORNE SPECTRORADIOMETER.
McKim, H.L., et al, *Photogrammetric engineering and remote sensing,* Mar. 1984, 50(3), p.353-360, 9 refs.
Merry, C.J., Layman, R.W.
38-3554
SUSPENDED SEDIMENTS, RADIOMETRY, SPECTRA, LAKE WATER, RESERVOIRS, RIVERS, AIRBORNE EQUIPMENT, SUNLIGHT.

An airborne 500-channel spectroradiometer developed and built by Chiu and Collins (1978) was tested to determine its usefulness to the U.S. Army Corps of Engineers for monitoring the suspended load in lakes, reservoirs, and waterways. Field and laboratory experiments were run to test and evaluate the radiometer's response to various levels of suspended organic and inorganic materials. A procedure to separate the sun glint, which is often a large percentage of the recorded signal, from the total signal was investigated. Results indicated that the accuracy of the airborne water turbidity measurements was sufficient to meet certain monitoring requirements of the Corps of Engineers.

MP 1719
SELF-SHEDDING OF ACCRETED ICE FROM HIGH-SPEED ROTORS.
Itagaki, K., *American Society of Mechanical Engineers. Winter Annual Meeting,* 1983, 83-WA/HT-68, p.1-6, 16 refs.
38-3565
ICE REMOVAL, AIRCRAFT ICING, PROPELLERS, ICE ACCRETION, SUPERCOOLED FOG, ICE ADHESION, ICE SOLID INTERFACE, SURFACE ENERGY, ICE CRACKS, ICE COVER THICKNESS, HELICOPTERS, ANALYSIS (MATHEMATICS).

Ice accreted on high-speed rotors operating in supercooled fog can be thrown off by centrifugal force, causing severe unbalance and creating dangerous projectiles. A simple force balance analysis indicates that the strength of accreted ice (and its adhesive strength) can be obtained by measuring the thickness of the accretion, the location of the separation, and the density. Such an analysis was applied to field and laboratory observations of self-shedding events. The results agree reasonably well with other observations.

MP 1720
ASYMPTOTIC BEHAVIOUR OF SOLUTIONS TO THE PROBLEM OF WETTING FRONTS IN ONE-DIMENSIONAL, HORIZONTAL AND INFINITE POROUS MEDIA.
Nakano, Y., *Advances in water resources,* June 1983, 6(2), p.71-78, 26 refs.
38-3567
POROUS MATERIALS, SOIL WATER, DIFFUSION, WETTABILITY, ANALYSIS (MATHEMATICS), WATER CONTENT, EXPERIMENTATION.

The asymptotic behavior of solutions to the problem of wetting fronts is studied in one-dimensional, horizontal and infinite porous media with the soil-water diffusivity proportional to some power of the water content. The uniqueness of the similarity solution for the problem is studied and the properties of this solution are presented. It is shown that the similarity solution is an asymptotic solution of a wide class of initial value problems of wetting fronts in the media. The use of the similarity solution is discussed for the experimental determination of the soil-water diffusivity.

MP 1721
SIMILARITY SOLUTIONS TO THE SECOND BOUNDARY VALUE PROBLEM OF UNSATURATED FLOW THROUGH POROUS MEDIA.
Nakano, Y., *Advances in water resources,* Dec. 1983, 6(4), p.205-213, 26 refs.
38-3568
POROUS MATERIALS, WATER FLOW, BOUNDARY VALUE PROBLEMS, SOIL WATER, DIFFUSION, WATER CONTENT, ANALYSIS (MATHEMATICS).

Similarity solutions to the second boundary value problem of unsaturated flow are studied in one-dimensional, semi-infinite porous media with the soil-water diffusivity proportional to some power of the water content. The existence and uniqueness of two types of similarity solutions to the problem are investigated and the properties of these solutions are presented. It is shown that these two types of similarity solutions exist and that they may not be unique for every parameter range studied. The use of the similarity solutions is discussed for the experimental determination of soil-water diffusivity.

MP 1722
PILING IN FROZEN GROUND.
Crory, F.E., *American Society of Civil Engineers. Technical Councils. Journal,* May 1982, 108(TC1), p.112-124, 30 refs.
36-3206
PILE STRUCTURES, FROZEN GROUND STRENGTH, PERMAFROST THERMAL PROPERTIES, FREEZE THAW CYCLES, COLD WEATHER CONSTRUCTION, LOADS (FORCES), FOUNDATIONS, FROST HEAVE, BEARING STRENGTH.

MP 1723
TEMPERATURE AND FLOW CONDITIONS DURING THE FORMATION OF RIVER ICE.
Ashton, G.D., et al, Symposium on Ice and its Action on Hydraulic Structures, Reykjavik, Iceland, Sept. 7-10, 1970. Papers and discussions, Reykjavik, Iceland, International Association for Hydraulic Research, 1970, 12p., In English with French summary. Session 2.4. 4 refs. Includes discussions.
Kennedy, J.F.
28-3971
RIVER ICE, ICE FORMATION, FLOW RATE, THERMAL REGIME, WATER TEMPERATURE.

MP 1724
RESILIENT MODULUS AND POISSON'S RATIO FOR FROZEN AND THAWED SILT AND CLAY SUBGRADE MATERIALS.
Chamberlain, E.J., et al, Preprints of papers presented at a specialty session of the ASCE Fall Convention and Exhibit, San Francisco, California, Oct. 17-21, 1977, American Society of Civil Engineers, 1977, p.229-281, 13 refs.
Cole, D.M., Johnson, T.C.
32-564
ROADS, SUBGRADE SOILS, SEASONAL FREEZE THAW, SOIL STRENGTH, LABORATORY TECHNIQUES.

MP 1725
ELECTRON MICROSCOPE ANALYSIS OF AEROSOLS IN SNOW AND DEEP ICE CORES FROM GREENLAND.
Kumai, M., *International Association of Hydrological Sciences. Publication,* 1977, No.118, International Symposium on Isotopes and Impurities in Snow and Ice, Grenoble, Aug. 28-30, 1975, p.341-350, In English with French summary. 10 refs.
32-3852
ELECTRON MICROSCOPY, AEROSOLS, SNOW COVER, ICE CORES.

MP 1726
GENERAL REPORT SESSION 2: MECHANICAL PROPERTIES.
Ladanyi, B., et al, *Engineering geology,* 1979, Vol.13, p.7-18, 5 refs.
Sayles, F.H.
36-1421
FROZEN GROUND MECHANICS, FROZEN GROUND STRENGTH, CONSTRUCTION MATERIALS, ARTIFICIAL FREEZING, ICE LENSES, GROUND ICE, TEMPERATURE GRADIENTS, DESIGN, PERMAFROST.

MP 1727
TEMPERATURE STRUCTURE AND INTERFACE MORPHOLOGY IN A MELTING ICE-WATER SYSTEM.
Yen, Y.-C., Frontiers in hydrology, Littleton, CO, Water Resources Publications, 1984, p.305-325, 22 refs.
38-3800
ICE MELTING, ICE WATER INTERFACE, MELTING POINTS, HEAT TRANSFER, TEMPERATURE DISTRIBUTION, WATER TEMPERATURE, BOUNDARY LAYER, CONVECTION, TURBULENT FLOW.

Nineteen tests were conducted with temperature measurements at various stages of melting experiments. Fourteen sets of photos were taken at various stages of the experiment for melting from above. Formation of concentric ridges was observed only for higher warmer boundary temperatures. However, there were more sharp-edged cavities at lower warm boundary temperatures as compared to those at warmer temperatures. The ice-water interface seemed to be much smoother at the junction of the cells in melting from below. These phenomena may be explained in that, in melting from above, the convective motions originate near the water-ice interface and therefore, may possess a greater intensity.

MP 1728

EFFECTS OF VOLUME AVERAGING ON SPECTRA MEASURED WITH A LYMAN-ALPHA HYGROMETER.

Andreas, E.L., *Journal of applied meteorology*, Apr. 1981, 20(4), p.467-475, 24 refs.

38-3865

HYGROMETERS, HUMIDITY, SPECTROSCOPY, MEASURING INSTRUMENTS, ANALYSIS (MATHEMATICS), VOLUME, ACCURACY.

Because the Lyman-alpha hygrometer averages turbulent fluctuations in humidity over a right circular cylinder, the spectral response of the instrument degrades at higher wavenumbers. This paper contains a derivation of the three-dimensional spectral averaging function and uses this function, with a new model for the scalar spectrum, to numerically evaluate how this spatial averaging affects measured humidity spectra and humidity variance dissipation rates. In general, hygrometer parameters can be chosen that allow spectral measurements to moderately high wavenumbers; but with the size of source and detector tubes currently in use, an accurate measurement of the humidity variance dissipation rate appears impossible.

MP 1729

LOCATING WET CELLULAR PLASTIC INSULATION IN RECENTLY CONSTRUCTED ROOFS.

Korhonen, C., et al, *Society of Photo-Optical Instrumentation Engineers. Proceedings*, 1983, Vol.371, p.168-173, 7 refs.

Tobiasson, W.

38-131

CELLULAR PLASTICS, ROOFS, INSULATION, MOISTURE DETECTION, WETTABILITY, TEMPERATURE MEASUREMENT.

Infrared scanners are quite successful in finding wet roof insulation, especially boards of rapidly absorbing insulations like perlite, wood fiber and fibrous glass. But wet areas develop more slowly and nonuniformly in the cellular plastic insulations, such as urethane, which are commonly used in new roofs. These differences can affect the outcome of an infrared survey of new roofs. To determine the feasibility of detecting incipient wet insulation, several recently constructed roofs were examined thermographically. It was usually more difficult to find moisture in new roofs containing cellular plastic insulations than in new roofs with more-absorbent insulations. This increased difficulty is due to the slower rate of wetting and to the nonuniform manner of wetting of some of the cellular plastics. Perlite, wood fiber and fibrous glass insulations tend to become uniformly wet throughout an entire board, whereas moisture initially concentrates at the perimeters of boards of some cellular plastic insulations. However, eight to ten months after construction, enough moisture can accumulate in most cellular plastic insulations to be visible to an infrared scanner. Since this moisture is concentrated in a small portion of each insulation board, much of it would probably be overlooked by a nuclear or capacitance grid survey.

MP 1730

FOUNDATIONS IN PERMAFROST AND SEASONAL FROST; PROCEEDINGS.

Session ₍on₎ Foundations in Permafrost and Seasonal Frost, Denver, CO, Apr. 29, 1985, New York, American Society of Civil Engineers, 1985, 62p., Refs. passim. For individual papers see 39-3579 through 39-3582.

Wuori, A.F., ed, Sayles, F.H., ed.

39-3578

PERMAFROST BENEATH STRUCTURES, FOUNDATIONS, PILE STRUCTURES, RHEOLOGY, FROZEN GROUND MECHANICS, LOADS (FORCES), SEASONAL FREEZE THAW, MEETINGS, DESIGN, COLD WEATHER CONSTRUCTION, SNOW COVER EFFECT, GROUND ICE.

MP 1731

CREEP OF A STRIP FOOTING ON ICE-RICH PERMAFROST.

Sayles, F.H., Session on Foundations in Permafrost and Seasonal Frost, Denver, CO, Apr. 29, 1985. Proceedings. Edited by A. Wuori and F.H. Sayles, New York, American Society of Civil Engineers, 1985, p.29-51, 41 refs.

39-3581

PERMAFROST BENEATH STRUCTURES, CREEP, LOADS (FORCES), STRESSES, SETTLEMENT (STRUCTURAL), RHEOLOGY, STRAINS, TESTS, COMPRESSIVE PROPERTIES.

Creep settlement tests were performed on a strip footing founded on the surface of ice-rich aeolian silt permafrost. The tests consisted of applying four step loadings to a 10 in. (25.4 cm) wide concrete footing. The step loads produced constant stresses at the base of the footing of 28, 56, and 111 psi (0.193, 0.385, and 0.770 MPa) for test periods of 12000, 6000 and 3500 hours respectively. The testing was conducted at an ambient temperature of 28.4 F (-2.0 C) in the controlled environment of the USACRREL Permafrost Tunnel Facility which is located near Fox, Alaska. Settlement and settlement rates of the footing were measured. These measured values are compared with those computed by different proposed analytical methods that utilize results from unconfined compression creep tests performed on undisturbed soil taken from the testing site. Preliminary results indicate reasonable agreement between computed and measured values.

MP 1732

FROST HEAVE FORCES ON PILING.

Esch, D.C., et al, *Alaska. Department of Transportation and Public Facilities. Research notes*, May 1985, 4(11), 2p.

Johnson, J.B.

40-508

FROST HEAVE, PILE EXTRACTION, PILE STRUCTURES, LOADS (FORCES), FROST PENETRATION, FROZEN GROUND MECHANICS, SOIL CREEP, SOIL PHYSICS, DESIGN, TESTS.

MP 1733

MEAN CHARACTERISTICS OF ASYMMETRIC FLOWS: APPLICATION TO FLOW BELOW ICE JAMS.

Gögüs, M., et al, *Canadian journal of civil engineering*, Sep. 1981, 8(3), p.342-350, With French summary. 13 refs.

Tatinclaux, J.C.

36-1795

ICE JAMS, FLOATING ICE, WATER FLOW, SUBSURFACE INVESTIGATIONS, SURFACE ROUGHNESS, SHEAR STRESS, RIVER ICE, HYDRAULICS, ANALYSIS (MATHEMATICS), TESTS.

MP 1734

GROUND SNOW LOADS FOR STRUCTURAL DESIGN.

Ellingwood, B., et al, *Journal of structural engineering*, Apr. 1983, 109(4), p.950-964, 13 refs.

Redfield, R.

37-3700

SNOW LOADS, ROOFS, SNOW WATER EQUIVALENT, STANDARDS, STATISTICAL ANALYSIS, STRUCTURES, DESIGN.

MP 1735

SEWAGE SLUDGE AIDS REVEGETATION.

Palazzo, A.J., et al, *Military engineer*, July-Aug. 1982, 74(481), p.198-301.

Gaskin, D.A., Wright, E.A.

38-3797

SEWAGE DISPOSAL, SLUDGES, REVEGETATION, SOIL FORMATION, GRASSES, GROWTH.

MP 1736

SOFT DRINK BUBBLES.

Cragin, J.H., *Journal of chemical education*, Jan. 1983, Vol.60, p.71, 2 refs.

38-3798

ICE WATER INTERFACE, BUBBLES, ICE MELTING, AIR ENTRAINMENT, CARBON DIOXIDE, NUCLEATION, AIR WATER INTERACTIONS, SOLUBILITY.

MP 1737

COMPARISON OF DIFFERENT SEA LEVEL PRESSURE ANALYSIS FIELDS IN THE EAST GREENLAND SEA.

Tucker, W.B., *Journal of physical oceanography*, June 1983, 13(6), p.1084-1088, 7 refs.

38-3799

ATMOSPHERIC PRESSURE, SEA LEVEL, SEA ICE, ICE MODELS, OCEANOGRAPHY, GREENLAND SEA.

MP 1738

OTTAUQUECHEE RIVER—ANALYSIS OF FREEZE-UP PROCESSES.

Calkins, D.J., et al, Workshop on Hydraulics of Ice-Covered Rivers, Edmonton, Alta., June 1 and 2, 1982. Proceedings, ₍1982₎, p.2-37, 3 refs.

Gooch, G.

38-4001

RIVER ICE, FREEZEUP, HEAT TRANSFER, ICE MECHANICS, FLOW RATE, METEOROLOGICAL FACTORS, ICE COVER THICKNESS, ICE VOLUME, TIME FACTOR, ANALYSIS (MATHEMATICS), DEGREE DAYS, UNITED STATES—VERMONT—OTTAUQUECHEE RIVER.

The results of three winters of freeze-up measurements on the Ottauquechee River have shown that the ice production heat transfer coefficient calculated from the ice volume measurements is somewhat related to the severity of the freeze-up meteorological conditions. A very intense cold period of -22 C for two days just as the river water temperature reached 0.0 C produced much higher ice volumes for the same river reach than two other freeze-up periods, which had average air temperatures of -7 C over 10 to 12 days. The intense cold period created higher ice discharges, which forced the leading edge to progress upstream at a faster rate than during other years. The lateral ice closure was found to be linearly related to the number of accumulated freezing degree-days. The data on lateral closure for this small river were also related to the freeze-up open channel flow velocity and, when combined with similar data from the Nelson River in Manitoba, produced a reasonable relationship. The slush ice also established an equilibrium flow area at several measured cross sections throughout the study reach.

MP 1739

FORCE MEASUREMENTS AND ANALYSIS OF RIVER ICE BREAK UP.

Deck, D.S., Workshop on Hydraulics of Ice-Covered Rivers, Edmonton, Alta., June 1 and 2, 1982. Proceedings, ₍1982₎, p.303-336, 19 refs.

38-4015

ICE LOADS, ICE PRESSURE, STRUCTURES, ICE BREAKUP, RIVER ICE, ICE CONTROL, ICE BOOMS, ICE FORECASTING, ICE MECHANICS, FLOATING ICE, COUNTERMEASURES, FRAZIL ICE, DESIGN.

Measurements were made near Oil City, Pennsylvania, during February 1981 to evaluate the performance of a floating ice control structure during an ice run on a shallow and steep stream, Oil Creek. The primary objective of the structure was to assist in forming an early, stable ice cover upstream of Oil City that would prevent prolonged frazil ice generation. The control structure was a double timber ice boom. This paper focuses on the forces exerted on the structure during ice breakup. The forces transmitted to the ice control structure prior to breakup and during the ice run were monitored through a strain-gaged tension link, which had been incorporated into the design of the structure, and this ice force was recorded with respect to time.

MP 1740

FREEZING OF A SEMI-INFINITE MEDIUM WITH INITIAL TEMPERATURE GRADIENT.

Lunardini, V.J., *Journal of energy resources technology*, Mar. 1984, 106(1), p.103-106, Revision of 37-2397. 12 refs.

38-4127

SOIL FREEZING, STEFAN PROBLEM, HEAT TRANSFER, TEMPERATURE GRADIENTS, GEOTHERMY, HEAT BALANCE, THERMAL CONDUCTIVITY, ANALYSIS (MATHEMATICS).

Exact solutions to problems of conductive heat transfer with solidification are rare due to the nonlinearity of the equations. The heat balance integral technique is used to obtain an approximate solution to the freezing of a semi-infinite region with a linear, initial temperature distribution. The results indicate that the constant temperature Neumann solution is acceptable for soil systems with a geothermal gradient unless extremely long freezing times are considered. The heat balance integral will yield good solutions, with simple numerical work, even for nonconstant initial temperatures.

MP 1741

ICE ACTION ON TWO CYLINDRICAL STRUCTURES.

Kato, K., et al, *Journal of energy resources technology*, Mar. 1984, 106(1), p.107-112, 17 refs. For another source see 38-641 (MP 1643).

Sodhi, D.S.

38-4128

ICE LOADS, OFFSHORE STRUCTURES, ICE PRESSURE, ICE SOLID INTERFACE, EXPERIMENTATION.

Ice action on two cylindrical structures, located side by side, has been investigated in a small-scale experimental study to determine the interference effects on the ice forces generated during ice structure interaction. The proximity of the two structures changes the mode of ice failure, the magnitude and direction of ice forces on the individual structure, and the dominant frequency of ice force variations. Interference effects were determined by comparing the experimental results of tests at different structure spacings.

MP 1742

THERMAL PATTERNS IN ICE UNDER DYNAMIC LOADING.

Fish, A.M., et al, *Society of Photo-Optical Instrumentation Engineers. Proceedings*, 1983, Vol.430, p.240-243, 9 refs.

Marshall, S.J., Munis, R.H.

38-4120

ICE PHYSICS, DYNAMIC LOADS, HEAT TRANSFER, ICE SPECTROSCOPY, ICE THERMAL PROPERTIES, PLATES, TESTS.

Heat emission patterns in the infrared spectrum were discovered in ice subjected to cyclic loading. The ice plates used in the tests had a rectangular shape of 13 x 19 cm and a thickness of 2 cm. The plates were frozen to the platen of the testing apparatus to form a cantilever beam and were vibrated over a frequency range from 0.5 to 5 kHz at an ambient temperature of -4 C. The surface heat patterns were scanned by two thermal imaging systems with spectral band passes of 2-5.6 micron and 8-14 micron, and the heat patterns were recorded on Polaroid film and on videotape. The heat emission patterns first appeared at the fixed end of the ice plate and migrated gradually to the free end. The temperature difference between the ends was found to depend on the duration and frequency of excitation. The results of these tests indicate that vibrothermography can have wide areas of practical application in the study of the origin and growth of defects, recrystallization, fatigue, and failure processes in ice.

MP 1743

OFFSHORE OIL IN THE ALASKAN ARCTIC.

Weeks, W.F., et al, *Science*, July 27, 1984, 225(4660), p.371-378, Numerous refs.
Weller, G.
38-4117

NATURAL RESOURCES, OFFSHORE DRILLING, OIL RECOVERY, SEA ICE, ICE LOADS, ICE SCORING.

Oil and gas deposits in the Alaskan Arctic are estimated to contain up to 40 percent of the remaining undiscovered crude oil and oil-equivalent natural gas within U.S. jurisdiction. Most (65 to 70 percent) of these estimated reserves are believed to occur offshore beneath the shallow, ice-covered seas of the Alaskan continental shelf. Offshore recovery operations for such areas are far from routine, with the primary problems associated with the presence of ice. Some problems that must be resolved if efficient, cost-effective, environmentally safe, year-round offshore production is to be achieved include the accurate estimation of ice forces on offshore structures, the proper placement of pipelines beneath ice-produced gouges in the sea floor, and the cleanup of oil spills in pack ice areas. (Auth.)

MP 1744

POTENTIAL USE OF SPOT HRV IMAGERY FOR ANALYSIS OF COASTAL SEDIMENT PLUMES.

Band, L.E., et al, 1984 SPOT Symposium. Proceedings. SPOT simulation applications handbook, American Society of Photogrammetry, 1984, p.199-204, 5 refs.
McKim, H.L., Merry, C.J.
40-3548

BOTTOM SEDIMENT, SEDIMENT TRANSPORT, REMOTE SENSING, WATER POLLUTION, SPECTROSCOPY, DISTRIBUTION.

Simulated SPOT (HVR) 20-m multispectral data were obtained on 7 July 1984 over the Hart-Miller Island diked spoil containment facility located in the upper Chesapeake Bay. Sediment plumes were clearly visible and indicated the sediment transport direction at the time the image was taken. The portion of the image along the bay side of the island had strong specular reflection. The image was preprocessed to remove the majority of the specular reflection. The Sobel operator was applied to the enhanced simulated SPOT image. A set of edge segments were generated that follow the boundaries of the major sediment plumes. The strength of the edges was quite variable, reflecting the varying diffusion of the plume border. The Sobel edge-enhanced image showed two sets of plumes. The edge intensity was generally stronger nearer the source. Profiles of pixel digital number were taken at two distances, normal to the long axes of two sediment source areas. The cross sections taken through the plumes were plotted.

MP 1745

EFFECTS OF PHASE III CONSTRUCTION OF THE CHENA FLOOD CONTROL PROJECT ON THE TANANA RIVER NEAR FAIRBANKS, ALASKA—A PRELIMINARY ANALYSIS.

Buska, J.S., et al, Overview of Tanana River monitoring and research studies near Fairbanks, Alaska. Prepared by U.S. Army Cold Regions Research and Engineering Laboratory, U.S. Army Corps of Engineers, Jan. 1984, 11p. + figs., Appendix A.
Barrett, S., Chacho, E.F., Collins, C.M., Young, S.A.
38-4207

FLOOD CONTROL, COLD WEATHER CONSTRUCTION, SOIL EROSION, RIVER FLOW, BANKS (WATERWAYS), AERIAL SURVEYS, PHOTOGRAPHY, COUNTERMEASURES, UNITED STATES—ALASKA—TANANA RIVER.

The Alaska District, Corps of Engineers initiated a program called the Tanana River Monitoring and Research Program to determine if any adverse impacts are occurring or may occur as a result of Phase III construction of the Chena Flood Control Project. The results of the monitoring efforts and a preliminary analysis of the Phase III construction are presented in this report. Aerial photography and river cross-sections were used to document historical changes from 1961 to 1981. Riverbank erosion and channel changes before and after the Phase III construction are evaluated to determine the effects of the construction on the natural river process.

MP 1746

RELATIONSHIPS AMONG BANK RECESSION, VEGETATION, SOILS, SEDIMENTS AND PERMAFROST ON THE TANANA RIVER NEAR FAIRBANKS, ALASKA.

Gatto, L.W., Overview of Tanana River monitoring and research studies near Fairbanks, Alaska. Prepared by U.S. Army Cold Regions Research and Engineering Laboratory, U.S. Army Corps of Engineers, Jan. 1984, 59p., Appendix B. 30 refs.
38-4208

BANKS (WATERWAYS), SOIL EROSION, FLOOD CONTROL, VEGETATION, PERMAFROST BENEATH RIVERS, SEDIMENTS, UNITED STATES—ALASKA—TANANA RIVER.

The objective of this analysis was to determine if available data are useful in identifying the characteristics that contribute to erodibility of the banks along two reaches of the Tanana River. Existing data on bank vegetation, soils, sediments and permafrost were used. Because these data were general and not collected for the purpose of site-specific analysis, my analytical approach was simple and did not include any statistical tests. The data were visually compared to the locations and estimated amounts of historical recession to evaluate if any relationships were obvious.

MP 1747

BANK RECESSION AND CHANNEL CHANGES IN THE AREA NEAR THE NORTH POLE AND FLOODWAY SILL GROITS, TANANA RIVER, ALASKA.

Gatto, L.W., et al, Overview of Tanana River monitoring and research studies near Fairbanks, Alaska. Prepared by U.S. Army Cold Regions Research and Engineering Laboratory, U.S. Army Corps of Engineers, Jan. 1984, 98p., Appendix C. 5 refs.
Riley, K.W.
38-4209

BANKS (WATERWAYS), CHANNELS (WATERWAYS), SOIL EROSION, FLOOD CONTROL, PHOTOGRAPHY, AERIAL SURVEYS, UNITED STATES—ALASKA—TANANA RIVER.

Two diversion groins, one near North Pole, Alaska, and the other 7 miles upstream on the Tanana River near the floodway sill, were built in 1975 and 1979 along the flood control levee that protects Fairbanks from flooding of the Chena and Tanana rivers. A flood control plan includes construction of new groins wherever it appears likely that bank erosion may threaten the levee. The objectives of this analysis were to measure bank recession, to describe channel changes before and after construction of the two groins, and to evaluate relationships among erosion, channel changes and discharge. Data from this analysis and future evaluations will be used in selecting sites for future groins.

MP 1748

EROSION ANALYSIS OF THE NORTH BANK OF THE TANANA RIVER, FIRST DEFERRED CONSTRUCTION AREA.

Collins, C.M., Overview of Tanana River monitoring and research studies near Fairbanks, Alaska. Prepared by U.S. Army Cold Regions Research and Engineering Laboratory, U.S. Army Corps of Engineers, Jan. 1984, 8p. + figs., Appendix D. 1 ref.
38-4210

BANKS (WATERWAYS), SOIL EROSION, FLOOD CONTROL, PROTECTION, AERIAL SURVEYS, UNITED STATES—ALASKA—TANANA RIVER.

MP 1749

ROLE OF SEA ICE DYNAMICS IN MODELING CO2 INCREASES.

Hibler, W.D., III, *American Geophysical Union. Geophysical monograph*, 1984, No.29, p.238-253, 21 refs.
38-4249

CLIMATIC CHANGES, SEA ICE DISTRIBUTION, ICE MECHANICS, ICE MODELS, ICE TEMPERATURE, DRIFT, THERMODYNAMICS, ALBEDO, SEA WATER.

Sensitivity simulations of a hierarchy of Antarctic sea ice models to atmospheric warming are carried out and analyzed. The study includes models with only a thermodynamic ice cover, models with *in-situ* leads but no ice transport, and a fully coupled dynamic/thermodynamic model that includes transport, leads and strength-thickness coupling. All models employ a 60-m-thick oceanic mixed layer, together with a spatially and temporally varying heat flux into the mixed layer from the deep ocean. The heat flux was generated interactively by using a fixed fraction of the ice growth and cooling rates from the full dynamic/thermodynamic model. The same spatially and temporally varying heat flux fields were used in all sensitivity simulations. Models including full ice dynamics effects are found to be less sensitive to atmospheric warming than thermodynamics-only models, while models with specified lead fractions are more sensitive than thermodynamics-only models. (Auth. mod.)

MP 1750

PROJECTILE AND FRAGMENT PENETRATION INTO ORDINARY SNOW.

Swinzow, G.K., Hanover, NH, U.S. Army Cold Regions Research and Engineering Laboratory, 1977, 30p., Unpublished manuscript. 10 refs.
38-4378

PROJECTILE PENETRATION, SNOW COVER EFFECT, MILITARY OPERATION, SNOW DENSITY, MILITARY ENGINEERING, PROTECTION, PENETRATION TESTS, PHOTOGRAPHY.

A soldier on the battlefield is told to "dig in" to protect himself against projectiles and fragments. But in cold regions or seasons the ground may be hard, suitable only for deliberate field fortifications built using machines and explosives. However, a winter battlefield scenario often contains an excellent protective material: the snow cover. Often neglected or considered a nuisance, snow can be an obstacle and a disadvantage for the ignorant and a decisive advantage for the properly trained and knowledgeable soldier. Construction of a protective structure made of ordinary snow requires an order of magnitude less effort in time, manpower and energy than is required to obtain the same amount of protection by using sand bags or by "digging in." We have found that small arms projectiles penetrate only 2 m into a snowpile and that protection against recoilless rifle ammunition (HEAT) of the shaped charge type requires less than 4 m of ordinary snow. Our findings indicate that energy to penetration depth relations are complex and that point detonating fuzes may present greater difficulties in snow covered terrain.

MP 1751

STUDY OF A GROUNDED FLOEBERG NEAR REINDEER ISLAND, ALASKA.

Kovacs, A., Hanover, NH, U.S. Army Cold Regions Research and Engineering Laboratory, July 1977, 9p., Unpublished technical report.
38-4377

GROUNDED ICE, ICE SCORING, ICE FLOES, ICE PILEUP, PRESSURE RIDGES, DRIFT, UNITED STATES—ALASKA—PRUDHOE BAY.

MP 1752

SIMPLE BOOM ASSEMBLY FOR THE SHIPBOARD DEPLOYMENT OF AIR-SEA INTERACTION INSTRUMENTS.

Andreas, E.L., et al, *Ocean engineering*, 1984, 11(3), p.227-237, For another source see 38-868 or 13G-28929. 21 refs.
Rand, J.H., Ackley, S.F.
38-4422

MARINE METEOROLOGY, METEOROLOGICAL INSTRUMENTS, MEASURING INSTRUMENTS, BOOMS (EQUIPMENT), SHIPS, ANTARCTICA.

We have developed a simple boom for use in measuring meteorological variables from a ship. The main structural member of the boom, a triangular communications tower with rollers attached along its bottom side, is deployed horizontally from a long, flat deck, such as a helicopter deck, and will support a 100-kg payload at its outboard end. The boom is easy to deploy, requires mimimal ship modifications, and provides ready access to the instruments mounted on it. And because it is designed for use with the ship crosswind, oceanographic work can go on at the same time as the air-sea interaction measurements. We describe our use of the boom on the *Mikhail Somov* during a cruise into the Antarctic sea ice and present some representative measurements made with instruments mounted on it. Theory, experiment, and our data all imply that instruments deployed windward from a rear helicopter deck can reach air undisturbed by the ship. Such an instrument site has clear advantages over the more customary mast, bow, or buoy locations. (Auth.)

MP 1753

SOIL MICROBIOLOGY.

Bosatta, E., et al, Simulation of nitrogen behaviour of soil-plant systems. Edited by M.J. Frissel and J.A. van Veen. Wageningen, the Netherlands, Pudoc, Centre for Documentation, 1981, p.38-44.
Iskandar, I.K., Juma, N.G., Kruh, G., Reuss, J.O., Tanji, K.K., Veen, J.A. van.
38-4435

SOIL MICROBIOLOGY, UREA, NUTRIENT CYCLE, MATHEMATICAL MODELS.

MP 1754

ATMOSPHERIC CONDITIONS AND CONCURRENT SNOW CRYSTAL OBSERVATIONS DURING SNOW-ONE-A.

Bilello, M.A., et al, *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* Mar. 1983, No.83-04, Snow Symposium 2, Vol.1, p.3-18, ADB-073 046, 14 refs.
O'Brien, H.
38-4305
SNOWFALL, SNOW CRYSTAL STRUCTURE, SNOW OPTICS, SYNOPTIC METEOROLOGY, AIR MASSES, AIR TEMPERATURE, HUMIDITY, WEATHER OBSERVATIONS, FALLING BODIES.

A survey of the synoptic weather patterns and vertical profiles of temperature and humidity over northern Vermont was conducted during periods of snowfall between December 1981 and February 1982. The crystal habit of falling snow, discerned principally from on-site optical microscopy, was also observed during this period. This information was used to investigate the association between air mass characteristics and snow crystal types. The ultimate objective of the analysis is to link large-scale weather conditions with the observed physical features of falling frozen particles and with measurements recorded concurrently by electro-optical sensor systems.

MP 1755

NORTHWEST SNOWSTORM OF 15-16 DECEMBER 1981.

Bates, R.E., *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* Mar. 1983, No.83-04, Snow Symposium 2, Vol.1, p.19-34, ADB-073 046, 4 refs.
38-4306
SNOWSTORMS, SNOW DEPTH, SNOWFALL, SYNOPTIC METEOROLOGY, METEOROLOGICAL DATA.

This paper contains a detailed description of meteorological conditions (including upper air) of an intense Northeast snowstorm that occurred in mid-December 1981. The paper relates the on-site meteorology to the overall concurrent synoptic situation. Consideration is given to air mass, hydrometeor intensity, visibility and crystal habit along the SNOW-ONE-A primary line-of-site.

MP 1756

FALLING SNOW CHARACTERISTICS AND EXTINCTION.

Berger, R.H., *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* Mar. 1983, No.83-04, Snow Symposium 2, Vol.1, p.61-69, ADB-073 046, 2 refs.
38-4309
SNOWFALL, LIGHT TRANSMISSION, PARTICLE SIZE DISTRIBUTION, PRECIPITATION GAGES, LIGHT SCATTERING.

An examination of the literature shows that a single relationship between the extinction and the precipitation rate does not exist for snow as it does for rain. This is due in part to the wide range of particle sizes and shapes which determine both the optical and mechanical properties of snow. The extinction measurements and extensive snow characterization made during the SNOW-ONE and SNOW-ONE-A field experiments provide the data for an examination of the dependence of the extinction on various snow characteristics. The correlations between the extinction and several snow characterization parameters are presented.

MP 1757

VISIBLE PROPAGATION IN FALLING SNOW AS A FUNCTION OF MASS CONCENTRATION AND CRYSTAL TYPE.

Lacombe, J., et al, *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* Mar. 1983, No.83-04, Snow Symposium 2, Vol.1, p.103-111, ADB-073 046, 8 refs.
Koh, G., Curcio, J.A.
38-4311
LIGHT TRANSMISSION, ATTENUATION, SNOWFALL, SNOW CRYSTAL STRUCTURE, SNOW OPTICS, OPTICAL PROPERTIES, DENSITY (MASS/VOLUME).

At SNOW-ONE-A mass concentration of falling snow was measured in conjunction with measurements of visible transmittance and observations of snow crystal type. An examination of a significant portion of the resulting data base reveals that a general correlation exists between visible attenuation and snow concentration. The data also indicate that crystal habit is a major factor affecting the relationship between attenuation and concentration.

MP 1758

FREE WATER MEASUREMENTS OF A SNOWPACK.

Fisk, D.J., *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* Mar. 1983, No.83-04, Snow Symposium 2, Vol.1, p.173-176, ADB-073 046, 2 refs.
38-4317
SNOW WATER CONTENT, TEMPERATURE MEASUREMENT, UNFROZEN WATER CONTENT, SNOW MELTING, CALORIMETERS.

A review is given of methods (melting and freezing calorimetry) previously used for measuring the free water content of snow on the ground. Their merits and faults are described. A new method, developed by the author, based on the temperature depression observed when a snow sample is completely dissolved in ethanol, is described and compared to the melting and freezing calorimetric methods.

MP 1759

PERFORMANCE AND OPTICAL SIGNATURE OF AN AN/VVS-1 LASER RANGEFINDER IN FALLING SNOW: PRELIMINARY TEST RESULTS.

Lacombe, J., *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* Mar. 1983, No.83-04, Snow Symposium 2, Vol.1, p.253-266, ADB-073 046, 10 refs.
38-4324
SNOW OPTICS, SNOWFALL, LIGHT TRANSMISSION, ELECTROMAGNETIC PROPERTIES, BLOWING SNOW, PHOTOGRAPHY, LASERS, SNOWSTORMS, ATTENUATION, MEASURING INSTRUMENTS, VISIBILITY.

An AN/VVS-1 pulsed ruby laser rangefinder was operated during the February 9, 1982 snow storm at SNOW-ONE-A. The device's digital readout was monitored as the system ranged over known distances to several targets. System performance has been evaluated relative to detailed measurements of airborne-snow concentration, precipitation rate and visible transmittance. Observations of the rangefinder's optical signature have been made using a video camera and still photography. This work was accomplished during both clear-air and light-snowfall conditions.

MP 1760

CHEMICAL OBSCURANT TESTS DURING WINTER: ENVIRONMENTAL FATE.

Cragin, J.H., *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* Mar. 1983, No.83-04, Snow Symposium 2, Vol.1, p.267-272, ADB-073 046, 3 refs.
38-4325
SNOW OPTICS, INFRARED RECONNAISSANCE, AEROSOLS, CHEMICAL ANALYSIS, POLLUTION, TEMPERATURE EFFECTS, SAMPLING, TESTS.

Concentrations of orthophosphate, IR1 and IR2 obscurants were measured in surface snow samples after a wintertime test of white phosphorus (WP) smoke and the two infrared screeners. Sample concentrations of IR1 and IR2 decreased exponentially downwind from the smoke release point. Orthophosphate concentrations were all less than the analytical detection limit of 0.15 mg/L. Quantities of smoke released pose no hazard to the public or environment. Snow was found to provide a clean non-contaminating surface upon which to collect the deposited aerosol.

MP 1761

ON SMALL-SCALE HORIZONTAL VARIATIONS OF SALINITY IN FIRST-YEAR SEA ICE.

Tucker, W.B., et al, *Journal of geophysical research,* July 20, 1984, 89(C4), p.6505-6514, 20 refs.
Gow, A.J., Richter, J.A.
38-4365
SEA ICE, ICE SALINITY, BRINES, VARIATIONS.

Measurements of salinity over horizontal distances of 38 to 76 cm in a thick first-year ice sheet have revealed significant differences. A maximum salinity difference of 2 per mill was observed between ice core segments from the same depth. The mean standard deviation for 10-cm thickness increments through the 2.0-m ice sheet was 0.39 per mill between the five closely spaced cores. The most likely mechanisms for these significant differences in salinity over short distances is differential brine drainage in the ice sheet due to varying locations of brine drainage channels. A simple one-dimensional model which assumes a normally distributed arrangement of brine drainage channels provides results consistent with the horizontal differences observed. (Auth.)

MP 1762

WASTEN: A MODEL FOR NITROGEN BEHAVIOUR IN SOILS IRRIGATED WITH LIQUID WASTE.

Selim, H.M., et al, Simulation of nitrogen behaviour of soil-plant systems. Edited by M.J. Frissel and J.A. van Veen, Wageningen, Netherlands, Centre for Agricultural Publication, [1984], p.96-108, 19 refs.
Iskandar, I.K.
39-234
WASTE TREATMENT, WATER TREATMENT, CHEMICAL ANALYSIS, LAND RECLAMATION, WASTE DISPOSAL, IRRIGATION, MATHEMATICAL MODELS, SOIL WATER, FORECASTING, COMPUTER APPLICATIONS.

MP 1763

ICE COVER MELTING IN A SHALLOW RIVER.

Calkins, D.J., *Canadian journal of civil engineering,* June 1984, 11(2), p.255-265, With French summary. 9 refs.
38-4401
ICE MELTING, RIVER ICE, ICE JAMS, HEAT TRANSFER, FRAZIL ICE, WATER TEMPERATURE, RIVER FLOW, FREEZING POINTS, DIURNAL VARIATIONS, TEMPERATURE DISTRIBUTION.

The heat transfer coefficients computed from field data on both ice cover melting and water temperature attenuation are higher than the values one would compute based on extrapolation of previous laboratory flume data. The computed heat transfer coefficients were relatively consistent when calculated from the water temperature decay data. Consistent results were also obtained with one set of very detailed ice cover melting data. The diurnal fluctuation in water temperature from the freezing point to values of 0.4-0.6 C was associated with the incoming solar radiation and the open water surface area. The measured water temperature distribution beneath the ice cover at a particular cross section varied from 0.2 to 0.6 C due to the influence of frazil ice and flow distribution. In the open water reaches the water temperature was essentially fully mixed vertically but lateral variation across the river ranged from 0.1 to 0.3 C. The average daily melting of the ice cover often exceeded 5.0 cm and at some locations the rate was as high as 8 cm/d. The melt was not uniform across the section but was highly dependent upon the flow conditions, velocity, and depth. The ice cover melting for this year only occurred during the daylight hours as the air temperatures dropped below 0 C at night and the water temperature likewise decayed to its freezing point.

MP 1764

SURFACE ROUGHNESS OF ROSS SEA PACK ICE.

Govoni, J.W., et al, *Antarctic journal of the United States,* 1983, 18(5), p.123-124, 5 refs.
Ackley, S.F., Holt, E.T.
39-16
SEA ICE, PACK ICE, ICE SURFACE, MEASURING INSTRUMENTS, ANTARCTICA—ROSS SEA.

At the end of the 1980 austral winter, sea-ice surface roughness was assessed along selected tracks in the Ross Sea. The ice surveyed consisted mainly of first-year pack ice. Surface profiles were made using a Spectra-Physics Geodolite 3A laser profilometer which was mounted vertically in the camera bay of a National Science Foundation LC-130 aircraft. The profilometer, recording equipment and measurement technique are described. For the data analyzed to date, the Ross Sea region appears in general to have much less ridging than either the Weddell Sea or the Arctic Basin. The open nature of the boundaries here leads to generally divergent conditions and diminishes the stress transmitted through the pack ice resulting in fewer high ridges. Near coastal boundaries, however, localized high stress may exist and ridging features develop accordingly.

MP 1765

TWO-DIMENSIONAL MODEL OF COUPLED HEAT AND MOISTURE TRANSPORT IN FROST-HEAVING SOILS.

Guymon, G.L., et al, *Journal of energy resources technology,* Sep. 1984, 106(3), p.336-343, 30 refs.
Hromadka, T.V., II, Berg, R.L.
39-24
HEAT TRANSFER, MOISTURE TRANSFER, FROST HEAVE, SOIL FREEZING, MODELS.

The model is based unon well known equations of heat and moisture flow in soils. Numerical solution is by the nodal domain integration method which includes the integrated finite difference and the Galerkin finite element methods. Solution of the phase change process is approximated by an isothermal approach and phenomenological equations are assumed for processes occurring in freezing or thawing zones. The model has been verified against experimental one-dimensional freezing soil column data and experimental two-dimensional soil thawing tank data as well as two-dimensional soil seepage data. The model has been applied to several simple but useful field problems such as roadway embankment freezing and frost heaving. (Auth.)

MP 1766

CREEP MODEL FOR CONSTANT STRESS AND CONSTANT STRAIN RATE.

Fish, A.M., Engineering Mechanics Division Specialty Conference, 5th, Laramie, WY, Aug. 1-3, 1984. Proceedings, Vol.2. Edited by A.P. Boresi and K.P. Chong, New York, American Society of Civil Engineers, 1984, p.1009-1012, 5 refs.

39-110

RHEOLOGY, STRESS STRAIN DIAGRAMS, CREEP, STRESSES, STRAINS, TESTS, THERMODYNAMICS.

MP 1767

MODEL SIMULATION OF 20 YEARS OF NORTHERN HEMISPHERE SEA-ICE FLUCTUATIONS.

Walsh, J.E., et al, *Annals of glaciology,* 1984, Vol.5, p.170-176, 20 refs.

Hibler, W.D., III, Ross, B.

39-193

SEA ICE DISTRIBUTION, ICE CONDITIONS, ICE MODELS, DRIFT, SURFACE TEMPERATURE, WIND FACTORS, PERIODIC VARIATIONS, SNOW COVER EFFECT, ICE COVER THICKNESS, CLIMATIC FACTORS.

A dynamic-thermodynamic sea-ice model (Hibler 1979) is used to simulate northern hemisphere sea ice for a 20-year period, 1961 to 1980. The model is driven by daily atmospheric grids of sea-level pressure (geostrophic wind) and by temperatures derived from the Russian surface temperature data set. Among the modifications to earlier formulations are the inclusion of snow cover and a multilevel ice-thickness distribution in the thermodynamic computations. The time series of the simulated anomalies show relatively large amounts of ice during the early 1960s and middle 1970s, and relatively small amounts during the late 1960s and early 1970s. The fluctuations of ice mass, both in the entire domain and in individual regions, are more persistent than are the fluctuations of ice-covered area. The ice dynamics tend to introduce more high-frequency variability into the regional (and total) amounts of ice mass. The simulated annual ice export from the Arctic basin into the East Greenland Sea varies interannually by factors of 3 to 4.

MP 1768

THERMAL EXPANSION OF SALINE ICE.

Cox, G.F.N., *Journal of glaciology,* 1983, 29(103), p.425-432, With French and German summaries. 10 refs.

39-204

ICE SALINITY, SEA ICE, THERMAL EXPANSION, ANALYSIS (MATHEMATICS), BRINES, TEMPERATURE EFFECTS.

The coefficient of thermal expansion of NaCl ice and natural sea ice is theoretically shown to be equal to the coefficient of thermal expansion of pure ice.

MP 1769

SNOW CONCENTRATION AND EFFECTIVE AIR DENSITY DURING SNOW-FALLS.

Mellor, M., *Journal of glaciology,* 1983, 29(103), p.505-507, With French and German summaries. 1 ref.

39-211

SNOWFALL, ATMOSPHERIC DENSITY, SNOW ACCUMULATION, DISTRIBUTION, VELOCITY.

MP 1770

OBSERVATIONS OF VOLCANIC TREMOR AT MOUNT ST. HELENS VOLCANO.

Fehler, M., *Journal of geophysical research,* Apr. 10, 1983, 88(B4), p.3476-3484, Comment by M.G. Ferrick and W.F. St. Lawrence. Ibid., July 10, 1984, 89(B7), p.6349-6350. 37 refs.

Ferrick, M.G., St. Lawrence, W.F.

39-325

VOLCANOES, ELASTIC WAVES, SPECTRA, SEISMOLOGY, WAVE PROPAGATION, SOIL MECHANICS, FLUID DYNAMICS, MOUNTAINS, THEORIES, UNITED STATES—WASHINGTON—MOUNT SAINT HELENS.

MP 1771

THERMODYNAMIC MODEL OF CREEP AT CONSTANT STRESS AND CONSTANT STRAIN RATE.

Fish, A.M., *Cold regions science and technology,* July 1984, 9(2), p.143-161, For another source see 38-4470. Refs. p.159-161.

39-339

RHEOLOGY, THERMODYNAMICS, FROZEN GROUND MECHANICS, STRESS STRAIN DIAGRAMS, SOIL CREEP, VISCOUS FLOW, MATHEMATICAL MODELS, TESTS, LOADS (FORCES).

A thermodynamic model has been developed that describes the entire creep process, including primary, secondary, and tertiary creep, and failure for both constant stress (CS) tests and constant strain rate (CSR) tests, in the form of a unified constitutive equation and unified failure criteria. Deformation and failure are considered as a single thermoactivated process in which the dominant role belongs to the change of entropy. Families of creep curves, obtained from uniaxial compression CS and CSR tests of frozen soil, respectively (both presented in dimensionless coordinates), are plotted as straight lines and are superposed, confirming the unity of the deformation and failure process and the validity of the model. A method is developed for determining the parameters of the model, so that creep deformation and the stress-strain relationship of ductile materials such as soils can be predicted based upon information obtained from either type of test.

MP 1772

METHOD OF DETECTING VOIDS IN RUBBLED ICE.

Tucker, W.B., et al, *Cold regions science and technology,* July 1984, 9(2), p.183-188, 9 refs.

Rand, J.H., Govoni, J.W.

39-343

PRESSURE RIDGES, ICE JAMS, ICE DETECTION, ICE PILEUP, SURFACE ROUGHNESS, POROSITY.

MP 1773

UNIAXIAL COMPRESSIVE STRENGTH OF FROZEN SILT UNDER CONSTANT DEFORMATION RATES.

Zhu, Y., et al, *Cold regions science and technology,* June 1984, 9(1), p.3-15, 8 refs.

Carbee, D.L.

39-327

FROZEN GROUND STRENGTH, STRESS STRAIN DIAGRAMS, COMPRESSIVE PROPERTIES, GROUND ICE, ICE CRYSTAL STRUCTURE, TESTS, STRAINS, VELOCITY, SOIL CREEP, RHEOLOGY, TEMPERATURE VARIATIONS, DENSITY (MASS/VOLUME).

Uniaxial compressive strength tests were conducted on remolded, saturated Fairbanks frozen silt under various constant machine speeds, temperatures and dry densities. Test results show that the peak strength of frozen silt is not sensitive to dry density (or water content) at 2 C, especially at relatively high strain rates, but is very sensitive to temperature and applied strain rate. However, the failure strain is not sensitive to temperature and strain rate within a wide range of strain, rate, but is very sensitive to dry density. It has been found that the initial yield strength consistently increases with decreasing dry unit weight. The initial yield strain is almost independent of dry density and temperature, but varies with strain rate. The initial tangent modulus of frozen silt is found to be nearly independent of strain rate, but the 50% strength modulus is closely related to strain rate. The test results indicate that there is a definite relationship between the two moduli.

MP 1774

FIELD DIELECTRIC MEASUREMENTS OF FROZEN SILT USING VHF PULSES.

Arcone, S.A., et al, *Cold regions science and technology,* June 1984, 9(1), p.29-37, 16 refs.

Delaney, A.J.

39-329

FROZEN GROUND PHYSICS, DIELECTRIC PROPERTIES, RADIO WAVES, PERMAFROST PHYSICS, GROUND ICE, TUNNELS, WAVE PROPAGATION, TRANSMISSION, ICE WEDGES, TESTS.

MP 1775

DIELECTRIC MEASUREMENTS OF FROZEN SILT USING TIME DOMAIN REFLECTOMETRY.

Delaney, A.J., et al, *Cold regions science and technology,* June 1984, 9(1), p.39-46.

Arcone, S.A.

39-330

FROZEN GROUND PHYSICS, DIELECTRIC PROPERTIES, GROUND ICE, REFLECTION, WATER CONTENT, TEMPERATURE EFFECTS, MEASURING INSTRUMENTS.

MP 1776

ELECTROMAGNETIC PROPERTIES OF SEA ICE.

Morey, R.M., et al, *Cold regions science and technology,* June 1984, 9(1), p.53-75, For another version see 38-4472. 27 refs.

Kovacs, A., Cox, G.F.N.

39-332

ICE ELECTRICAL PROPERTIES, SEA ICE, ELECTROMAGNETIC PROPERTIES, ICE SPECTROSCOPY, ICE CRYSTAL STRUCTURE, MICROSTRUCTURE, BRINES, ANALYSIS (MATHEMATICS), DIELECTRIC PROPERTIES.

Investigations of the in situ complex dielectric constant of sea ice were made using time-domain spectroscopy. It was found that (1) for sea ice with a preferred horizontal c-axis alignment, the anisotropy or polarizing properties of the ice increased with depth, (2) brine inclusion conductivity increased with decreasing temperature down to about -8 C, at which point the conductivity decreased with decreasing temperature, (3) the DC conductivity of sea ice increased with increasing brine volume, (4) the real part of the complex dielectric constant is strongly dependent upon brine volume but less dependent upon the brine inclusion orientation, (5) the imaginary part of the complex dielectric constant was strongly dependent upon brine inclusion orientation but much less dependent upon brine volume.

MP 1777

ELEMENTAL COMPOSITIONS AND CONCENTRATIONS OF MICROSPHERULES IN SNOW AND PACK ICE FROM THE WEDDELL SEA.

Kumai, M., et al, *Antarctic journal of the United States,* 1983, 18(5), p.128-131, 7 refs.

Ackley, S.F., Clarke, D.B.

39-307

PACK ICE, SNOW CRYSTALS, MICROELEMENT CONTENT, PARTICLES, ANTARCTICA —WEDDELL SEA.

This paper presents the results of an investigation of microspherules found in snow and pack ice from the Weddell Sea, Antarctica, collected during the U.S.-U.S.S.R. Weddell Polynya Expedition, 1981. Elemental composition, size, and concentration of microspherules were determined using a scanning electron microscope (SEM) and energy dispersive X-ray analysis (EDXA). Typical textures of microspherules are shown in this report and compared with those found in snow and ice-fog crystals sampled from the Northern Hemisphere. In this study, 23 microspherules were found in the snow sample from the Weddell Sea and 6 from the snow-ice sample. The concentration of microspherules in the snow samples is calculated to be approx 0.001 percent, three orders of magnitude smaller than that of the Northern Hemisphere. This indicates that the concentration of microspherules in the Antarctic may be three orders of magnitude smaller than the concentration found in the Northern Hemisphere. Silicon- and titanium-rich microspherules from the Weddell Sea were found in fly ash of terrestrial origin. The iron rich microspherules were tentatively identified to be of extraterrestrial origin.

MP 1778

LARGE-SCALE ICE/OCEAN MODEL FOR THE MARGINAL ICE ZONE.

Hibler, W.D., III, et al, *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* Apr. 1984, No.84-07, MIZEX bulletin. 3. Modeling the marginal ice zone, p.1-7, ADA-145 351, 14 refs.

Bryan, K.

39-361

ICE MECHANICS, ICE WATER INTERFACE, SEA ICE DISTRIBUTION, OCEAN CURRENTS, DRIFT, ICE MODELS, SEASONAL VARIATIONS, WATER TEMPERATURE, SALINITY, WIND FACTORS, VELOCITY.

MP 1779

EAST GREENLAND SEA ICE VARIABILITY IN LARGE-SCALE MODEL SIMULATIONS.

Walsh, J.E., et al, *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* Apr. 1984, No.84-07, MIZEX bulletin. 3. Modeling the marginal ice zone, p.9-14, ADA-145 351, 11 refs.

Hibler, W.D., III.

39-362

ICE MECHANICS, SEA ICE, ICE MODELS, THERMODYNAMICS, ICE CONDITIONS, DRIFT, ICE COVER THICKNESS, WIND FACTORS, GREENLAND SEA.

MP 1780

ON THE DECAY AND RETREAT OF THE ICE COVER IN THE SUMMER MIZ.

Maykut, G.A., *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* Apr. 1984, No.84-07, MIZEX bulletin. 3. Modeling the marginal ice zone, p.15-22, ADA-145 351, 15 refs.

39-363

SEA ICE DISTRIBUTION, ICE CONDITIONS, ICE MELTING, SOLAR RADIATION, ICE WATER INTERFACE, THERMODYNAMICS, ICE FLOES, HEAT FLUX, ICE MECHANICS, SEASONAL VARIATION, POLYNYAS.

MP 1781

ON THE ROLE OF ICE INTERACTION IN MARGINAL ICE ZONE DYNAMICS.

Leppäranta, M., et al, *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* Apr. 1984, No.84-07, MIZEX bulletin. 3. Modeling the marginal ice zone, p.23-29, ADA-145 351, 7 refs.

Hibler, W.D., III.

39-364

ICE MECHANICS, ICE WATER INTERFACE, ICE EDGE, ICE COVER THICKNESS, ICE CONDITIONS, ICE AIR INTERFACE, RHEOLOGY, WIND FACTORS, VISCOSITY, MATHEMATICAL MODELS.

MP 1782
ANALYSIS OF LINEAR SEA ICE MODELS WITH AN ICE MARGIN.
Leppäranta, M., *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* Apr. 1984, No.84-07, MIZEX bulletin. 3. Modeling the marginal ice zone, p.31-36, ADA-145 351.
39-365
ICE MODELS, SEA ICE, RHEOLOGY, VISCOSITY, ICE EDGE, PACK ICE, ANALYSIS (MATHEMATICS), LOADS (FORCES).

MP 1783
SOME SIMPLE CONCEPTS ON WIND FORCING OVER THE MARGINAL ICE ZONE.
Tucker, W.B., *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* Apr. 1984, No.84-07, MIZEX bulletin. 3. Modeling the marginal ice zone, p.43-48, ADA-145 351, 20 refs.
39-367
ICE MECHANICS, ICE EDGE, WIND PRESSURE, SHEAR PROPERTIES, ICE PACK, WIND DIRECTION, SURFACE ROUGHNESS.

MP 1784
VARIATION OF THE DRAG COEFFICIENT ACROSS THE ANTARCTIC MARGINAL ICE ZONE.
Andreas, E.L., et al, *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* Apr. 1984, No.84-07, MIZEX bulletin. 3. Modeling the marginal ice zone, p.63-71, ADA-145 351, 40 refs.
Tucker, W.B., Ackley, S.F.
39-370
ICE CONDITIONS, SEA ICE DISTRIBUTION, ICE EDGE, ATMOSPHERIC CIRCULATION, ICE SURFACE, SURFACE ROUGHNESS, AIR TEMPERATURE, WIND DIRECTION, ICE MODELS, BOUNDARY LAYER, ANTARCTICA—WEDDELL SEA.

In Oct. 1981 the U.S.-USSR Weddell Polynya Expedition crossed the Antarctic marginal ice zone (MIZ) near the Greenwich Meridian on the *Michail Somov*. Five radiosondes, launched along a 150-km track starting at the ice edge, showed profound modification of the atmospheric boundary layer (ABL) as increasing surface roughness decelerated the flow. An equation is presented for the dependence of the drag coefficient on ice concentration that should be useful for modeling the surface stress in marginal ice zones. The sounding profiles and meteorological data provided a comprehensive look at how surface roughness and temperature changes in the MIZ can affect the ABL.

MP 1785
MECHANISM FOR FLOE CLUSTERING IN THE MARGINAL ICE ZONE.
Leppäranta, M., et al, *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* Apr. 1984, No.84-07, MIZEX bulletin. 3. Modeling the marginal ice zone, p.73-76, ADA-145 351, 3 refs.
Hibler, W.D., III.
39-371
ICE FLOES, ICE CONDITIONS, SEA ICE DISTRIBUTION, ICE EDGE, DRIFT, ICE MECHANICS, ICE COVER THICKNESS.

MP 1786
RELATIVE ABUNDANCE OF DIATOMS IN WEDDELL SEA PACK ICE.
Clarke, D.B., et al, *Antarctic journal of the United States,* 1983, 18(5), p.181-182, 12 refs.
Ackley, S.F.
39-310
ALGAE, PACK ICE, FRAZIL ICE, CRYOBIOLOGY, ANTARCTICA—WEDDELL SEA.

Diatoms were found throughout the length of sea ice cores (average length, 75 cm) taken from the Weddell Sea during the Oct.-Nov. 1981 joint U.S.-U.S.S.R. study. As in previous studies it was found that the pennate forms were dominant. *Chaetoceros dichaeta* Ehrenberg was the only centric species which was "abundant" in the samples, and it has not previously been reported as abundant. Of the pennate species found in abundance, three have been found in abundance by other authors. These are *Nitzschia closterium* (Ehrenberg) W. Smith, *Nitzschia cylindrus* (Grunow) Hasle, and *Nitzschia subcurvata* Hasle. Also found to be numerically significant in the samples were *Nitzschia prolongatoides* Hasle, *Nitzschia turgiduloides* Hasle, *Tropidoneis glacialis* Heiden, and an unidentified *Navicula* species. The table lists the dominant species in each sample and their relative abundances. Five of these species have not previously been found in abundance in antarctic sea ice. Possible reasons for the variable species compositions in samples are discussed.

MP 1787
RESERVOIR BANK EROSION CAUSED BY ICE.
Gatto, L.W., *Cold regions science and technology,* Aug. 1984, 9(3), p.203-214, Refs. p.211-214.
39-397
ICE EROSION, BANKS (WATERWAYS), RESERVOIRS, ICE CONDITIONS, WATER LEVEL, BOTTOM SEDIMENT, SHORE EROSION.

The purpose of this study was to evaluate the documented and potential importance of ice erosion along reservoir banks. The evaluation is based on a literature review and on inferences drawn from field observations and experience. Very little is known about the amount of reservoir bank erosion caused by ice action, although considerable information exists on ice erosion processes along the shorelines and beaches of oceans, rivers and lakes. The importance of ice-related erosion along a reservoir bank would depend primarily on water level, but ice conditions and bank sediment characteristics would also be important. If the reservoir water level is at bank level, ice could directly erode a bank face. If the water is below the bank, ice would have no direct effect on it. However, ice could indirectly increase bank instability by disrupting and eroding nearshore and beach zones, which could lead to bank erosion.

MP 1788
PRELIMINARY INVESTIGATION OF THERMAL ICE PRESSURES.
Cox, G.F.N., *Cold regions science and technology,* Aug. 1984, 9(3), p.221-229, 16 refs.
39-399
ICE PRESSURE, ICE THERMAL PROPERTIES, STRESSES, RHEOLOGY, ICE TEMPERATURE, LAKE ICE, MATHEMATICAL MODELS, HYDRAULIC STRUCTURES.

Measured ice stress data are needed to verify and improve thermal ice thrust prediction models used in estimating ice forces on dams, bridge piers, locks and other hydraulic structures. During February and March, 1983, thermal ice pressures were measured in the ice on a small lake in central New Hampshire. Even though the ice sheet was relatively warm and only exhibited small changes in temperature, stresses up to 200 to 300 kPa were recorded with a newly designed biaxial ice-stress sensor. Ice stresses normal and parallel to the shore of the lake were similar. Given the rate of change of temperature of the ice, ice pressures were calculated for the measurement period using a uniaxial rheological model consisting of a spring and nonlinear dashpot connected in series. Calculated and measured stresses were in good agreement.

MP 1789
STATIC DETERMINATION OF YOUNG'S MODULUS IN SEA ICE.
Richter-Menge, J.A., *Cold regions science and technology,* Aug. 1984, 9(3), p.283-286, 3 refs.
39-406
ICE MECHANICS, SEA ICE, STRAINS, LOADS (FORCES), STRESSES, TENSILE PROPERTIES, TESTS.

MP 1790
EFFECTS OF MAGNETIC PARTICLES ON THE UNFROZEN WATER CONTENT OF FROZEN SOILS DETERMINED BY NUCLEAR MAGNETIC RESONANCE.
Tice, A.R., et al, *Soil science,* July 1984, 138(1), p.63-73, 14 refs.
Oliphant, J.L.
39-455
UNFROZEN WATER CONTENT, FROZEN GROUND PHYSICS, NUCLEAR MAGNETIC RESONANCE, PARTICLES, MAGNETIC PROPERTIES, GROUND THAWING.

Small ferromagnetic particles in soils locally change the magnetic field of a nuclear magnetic resonance (NMR) analyzer. This causes a decrease in the NMR signal intensity when NMR is being used to measure unfrozen water contents in partially frozen soils or total water contents in thawed soils. We mixed Tuto clay, a soil containing no magnetic particles, with various small amounts of pure powdered magnetite, and determined the NMR signal intensity while the samples were both thawed and partially frozen. Then we derived an equation that correlates the thawed sample signal intensity with the weight percent of powdered magnetite added. The unfrozen water content of the partially frozen samples could be determined accurately for samples containing up to 0.2 to 0.3% magnetite. Several methods for demagnetizing soils containing large amounts of magnetic particles were tried, with the most effective found to be stirring a slurry of the soil over a powerful permanent magnet. Accurate unfrozen water contents could be determined for all the partially frozen samples if some form of demagnetizing procedure was used on those samples containing the most magnetic particles.

MP 1791
ICE DETERIORATION.
Ashton, G.D., GLERL contribution, No.428, Great Lakes Ice Research Workshop, Columbus, OH, Oct. 18-19, 1983. Proceedings. Edited by R.A. Assel and J.G. Lyon, Ann Arbor, MI, Great Lakes Environmental Research Laboratory, Sep. 1984, p.31-38, 10 refs.
39-481
ICE DETERIORATION, ICE MELTING, HEAT TRANSFER, ICE COVER STRENGTH, HEAT FLUX, BOUNDARY LAYER, ICE DENSITY, THERMAL CONDUCTIVITY, ICE PHYSICS, ALBEDO.

MP 1792
WATER SUPPLY AND WASTE DISPOSAL ON PERMANENT SNOWFIELDS.
Reed, S.C., et al, *Canadian journal of civil engineering,* June 1985, 12(2), p.344-350, With French summary. 10 refs.
Bouzoun, J.R., Tobiasson, W.
39-4025
WATER SUPPLY, WASTE DISPOSAL, SNOW COVER EFFECT, WASTE TREATMENT, WATER CHEMISTRY, EQUIPMENT, ICE MELTING.

The snow and glacial ice on permanent snowfields must serve as both the water source and the receptacle for wastes for any human habitation. In addition, the snow also serves as the support media for any structural foundations and hence the thermal aspects of water supply and waste disposal can be critical. Most activity has occurred on the ice caps of Greenland and Antarctica and has ranged from small transient field parties to large permanent facilities in continuous use for over 25 years. Novel procedures to insure the reliable production of good quality water are described as well as the recommended criteria for water quantity depending on the size and duration of the activity. The various methods of wastewater disposal that have been used at temporary camps and permanent stations are described along with the results from studies that defined the fate of the wastewater following its discharge to the snow. Such definition is important to insure protection of the water supply as well as the thermal integrity of any structural foundation.

MP 1793
COLD FACTS OF ICE JAMS: CASE STUDIES OF MITIGATION METHODS.
Calkins, D.J., Natural Hazards Research and Applications Information Center special publication, No.11, Association of State Floodplain Managers Conference, 8th, Portland, ME, June 11-14, 1984. Proceedings. Managing high risk flood areas, 1985 and beyond, [1984], p.39-47, 10 refs.
40-4457
ICE JAMS, FLOODS, ICE CONTROL, ICE BREAKUP, ICE BOOMS, IMPACT STRENGTH, WATER LEVEL, ICE CONDITIONS.

MP 1794
POLARIZATION OF SKYLIGHT.
Bohren, C., *Weatherwise,* Oct. 1984, 37(5), p.261-265.
39-563
LIGHT (VISIBLE RADIATION), POLARIZATION (WAVES), CLOUDS (METEOROLOGY), LIGHT SCATTERING, PHOTOGRAPHIC TECHNIQUES, ELECTROMAGNETIC PROPERTIES, OPTICAL FILTERS.

MP 1795
CONTROLLING RIVER ICE TO ALLEVIATE ICE JAM FLOODING.
Deck, D.S., Conference [on] Water for Resource Development, Coeur d'Alene, Idaho, Aug. 14-17, 1984. Proceedings, 1984, p.524-528, 4 refs.
39-614
ICE JAMS, ICE CONTROL, RIVER ICE, FLOODING, ICE BOOMS, ICE BREAKUP, COUNTERMEASURES.

This paper addresses the author's involvement at two areas where ice jam flooding has caused severe economic hardship and loss of life. An ice boom has been used to control the formation of river ice at Oil City, Pennsylvania, and a permanent ice control structure will be constructed on Cazenovia Creek in West Seneca, New York, to control the river ice during break-up.

MP 1796
SALMON RIVER ICE JAMS.
Cunningham, L.L., et al, Conference [on] Water for Resource Development, Coeur d'Alene, Idaho, Aug. 14-17, 1984. Proceedings, 1984, p.529-533, 4 refs.
Calkins, D.J.
39-615
ICE JAMS, RIVER ICE, FLOODING, ICE CONDITIONS, FREEZEUP, ICE COVER THICKNESS, ICE CONTROL, MODELS, UNITED STATES—IDAHO—SALMON RIVER.

A study was undertaken to document the ice conditions leading to the ice jam flooding along the Salmon River in the vicinity of Salmon, Idaho. This short paper documents the ice conditions on the river during the freeze-up period and the simple analytical model used to predict the advance of the ice cover leading edge. Ice cover thickness in excess of 9 ft. (3 m) were measured at cross sections where shoving had occurred. The initiation of the ice cover for this reach of the river begins in a long, deep pool formed by an alluvial fan from Dump Creek that developed in the late 1800's. By improving the flow conveyance through the alluvial fan and increasing the flow velocity in the backwater behind it, the initiation of the freeze-up ice cover could be delayed, thereby delaying the arrival of the leading edge at Salmon, Idaho, and reducing the potential for ice jam flooding.

MP 1797
MODELING INTAKE PEFORMANCE UNDER FRAZIL ICE CONDITIONS.

Dean, A.M., Jr., Conference [on] Water for Resource Development, Coeur d'Alene, Idaho, Aug. 14-17, 1984. Proceedings, 1984, p.559-563, 5 refs.
39-616
WATER INTAKES, *FRAZIL* ICE, ICE CONDITIONS, WATER PIPES, ICING, MODELS, COUNTERMEASURES.

A water intake was modeled in a refrigerated flume in an active frazil icing environment in order to evaluate alternative modifications to the prototype structure. Conduit dimensions tested were 2.7-in. round, 4.6-in. round, 6-in. square, 8-in. square, and 12-in. square. Entrance shapes tested were square, quarter-rounded, and *elliptical*. Model flows varied from 50 *gpm to* 360 gpm, resulting in average model intake velocities of 0.8 fps to 2.8 fps. Corresponding Froude prototype velocities varied from 0.3 fps to 2.0 fps. The length scale varied from 1:6.5 to 1:16. Tests were run until a head was developed across the model intake which was equivalent to a 12-foot head on the prototype, or until the icing tendency of the structure was determined. The icing mechanism observed in the model included stoppering of the intake with ice masses, restriction of the intake with multiparticle masses, and gradual accumulation of frazil ice particles on the intake.

MP 1798
ICE JAMS IN SHALLOW RIVERS WITH FLOODPLAIN FLOW: DISCUSSION.

Beltaos, S., *Canadian journal of civil engineering*, June 1984, 11(2), p.370-371, 3 refs. Reply by Calkins p.372. For paper being discussed see 38-776, MP 1644.
38-4402
ICE JAMS, RIVER ICE, ICE COVER THICKNESS, RIVER FLOW, FLOODS.

MP 1799
SNOWPACK ESTIMATION IN THE ST. JOHN RIVER BASIN.

Power, J.M., et al, International Symposium on Remote Sensing of Environment, 14th, San Jose, Costa Rica, Apr. 23-30, 1980. Proceedings, [1980], p.467-486, 11 refs.
Merry, C.J., Trivett, N.B.A., Waterman, S.E.
39-601
SNOW COVER DISTRIBUTION, SNOW WATER EQUIVALENT, RIVER BASINS, REMOTE SENSING, SNOWMELT, VEGETATION FACTORS, LANDSAT, *ACCURACY, COMPUTER* APPLICATIONS, MODELS, MAPPING.

Two methods for computing basin areal average water equivalent of the snowpack based on point snow course measurements are discussed. One involves the use of a square grid databank of elevations and vegetation types which are regressed against snow water equivalent. The other method utilizes digital tapes of LANDSAT satellite imagery to delineate various vegetation categories throughout a basin. Snowcourse *values obtained* within a given vegetation category are then distributed over the area within each basin which contains that category of vegetation. Where possible, the methods were checked by deriving snowpack values for six basins in the Upper Saint John River basin for the spring of 1978. These values were then used as input to the SSARR model, and the resulting runoff hydrographs were compared to those obtained using the conventional "isoline mapping" method of distributing the snowcourse values. Lastly, a range of errors were introduced into the conventionally derived snowpack values, and the resulting range in errors of the runoff hydrographs were computed to determine the sensitivity of the SSARR model to errors in snowpack input.

MP 1800
COMMENTS ON "THEORY OF METAMORPHISM OF DRY SNOW" BY S.C. COLBECK.

Sommerfeld, R.A., *Journal of geophysical research*, June 20, 1984, 81(7), p.4963-4965, Includes reply by S.C. Colbeck. 9 refs. *For the original article see* 37-3571.
Colbeck, S.C.
39-763
METAMORPHISM (SNOW), SNOW CRYSTAL GROWTH, ICE CRYSTAL GROWTH, TEMPERATURE GRADIENTS, VAPOR DIFFUSION, ANALYSIS (MATHEMATICS).

MP 1801
SNOW LOADS ON STRUCTURES.

O'Rourke, M.J., Conference on Applied Techniques for Cold Environments, Anchorage, Alaska, May 17-19, 1978. Proceedings, Vol.1, New York, American Society of Civil Engineers, 1978, p.418-428, 15 refs.
32-3629
SNOW LOADS, ROOFS, WIND VELOCITY.

MP 1802
APPLICATION OF THE ANDRADE EQUATION TO CREEP DATA FOR ICE AND FROZEN SOIL.

Ting, J.M., et al, *Cold regions science and technology*, June 1979, 1(1), p.29-36, 10 refs.
Martin, R.T.
33-4238
ICE STRENGTH, FROZEN GROUND MECHANICS, STRAINS, CREEP.

MP 1803
VOLUMETRIC CONSTITUTIVE LAW FOR SNOW BASED ON A NECK GROWTH MODEL.

Brown, R.L., *Journal of applied physics*, Jan. 1980, 51(1), p.161-165, 10 refs.
34-2388
SNOW MECHANICS, SNOW DEFORMATION, SNOW CRYSTAL STRUCTURE, MODELS.

MP 1804
TUSSOCK REPLACEMENT AS A MEANS OF STABILIZING FIRE BREAKS IN TUNDRA VEGETATION.

Patterson, W.A., III, et al, *Arctic*, June 1981, 34(2), p.188-189, 7 refs.
Dennis, J.G.
36-1325
TUNDRA, FIRES, COUNTERMEASURES, REVEGETATION, VEGETATION, THERMOKARST.

MP 1805
CREEP BEHAVIOR OF FROZEN SILT UNDER CONSTANT UNIAXIAL STRESS.

Zhu, Y., et al, International Conference on Permafrost, 4th, Fairbanks, Alaska, July 17-22, 1983. Proceedings, Washington, D.C., National Academy Press, 1983, p.1507-1512, 10 refs.
Carbee, D.L.
38-1373
FROZEN GROUND STRENGTH, FROZEN GROUND MECHANICS, SOIL CREEP, COMPRESSIVE PROPERTIES, STRESS STRAIN DIAGRAMS, RHEOLOGY, TIME FACTOR.

MP 1806
MOBILIZATION, MOVEMENT AND DEPOSITION OF ACTIVE SUBAERIAL SEDIMENT FLOWS, MATANUSKA GLACIER, ALASKA.

Lawson, D.E., *Journal of geology*, May 1982, 90(3), p.279-300, 50 refs.
39-765
SEDIMENT TRANSPORT, GLACIAL DEPOSITS, GLACIER ABLATION, GLACIER MELTING, GLACIAL GEOLOGY, GLACIER SURFACES, MELTWATER, UNITED STATES—ALASKA—MATANUSKA GLACIER.

Subaerial sediment flow is the predominant process depositing diamictons at the *terminus* of Matanuska Glacier. Flows originate where sediments overlie glacier ice. Ablation of ice exposed in slopes disaggregates the overlying sediment and mixes it with meltwater and debris released simultaneously. This material generally flows only after its strength is further reduced by excess pore pressures and seepage pressures generated by *meltwater* from thawing ice. Moving sediment flows show reasonably systematic changes in physical attributes such as dimensions, texture, flow rates, density and erosional action, and in grain support and transport mechanisms that can be related to changes in the water content of their matrix material. At lowest water contents, flows support grains by their strength and move through shear in a thin zone at their base. Increased thicknesses of the zone in shear and deformation of other types accompany increased water contents, with grain interference and collisions, localized liquefaction and fluidization, transient turbulence, and bedload traction and saltation operating simultaneously in such moving flows. At highest water contents, flows appear fully liquefied. The fluidity of the sediment flow and the amount of water in the sediment flow channel determine the degree of preservation of the source flow's properties and the depositional morphology. Because mobilization of a sediment flow destroys the glacial sedimentary properties of its sediment source and, further, because the mechanics of transport and deposition develop new "non-glacial" properties in this sediment, the diamicton deposited in the glacial environment by sediment flow should not be called till.

MP 1807
CREEP BEHAVIOR OF FROZEN SILT UNDER CONSTANT UNIAXIAL STRESS.

Zhu, Y., et al, *Journal of glaciology and cryopedology*, Mar. 1984, 6(1), p.33-48, In Chinese with English summary. 13 refs. For another source see *38-1373* (MP 1805).
Carbee, D.L.
39-932
SOIL CREEP, FROZEN GROUND MECHANICS, RHEOLOGY, STRESSES, FROZEN GROUND STRENGTH, COMPRESSIVE PROPERTIES, FROZEN GROUND TEMPERATURE, GRAIN SIZE, *TESTS, TEMPERATURE EFFECTS*.

A series of unconfined compression creep tests was conducted on saturated frozen Fairbanks silt at constant-stress and constant-temperature conditions. The authors suggest that the creep of frozen soil be classified into two types: short-term and long-term creep. Different constitutive and strength-loss equations are presented for each type of creep. On the basis of Assur's creep model (1980) and this criterion, a creep equation was derived that can describe the entire process of creep of frozen soil.

MP 1808
MECHANICAL PROPERTIES OF SEA ICE: A STATUS REPORT.

Weeks, W.F., et al, *Ocean science and engineering*, 1984, 9(2), p.135-198, Refs. p.191-198.
Cox, G.F.N.
39-971
ICE STRENGTH, ICE MECHANICS, DRIFT, SEA ICE, ICE CRYSTAL STRUCTURE, RHEOLOGY, COMPRESSIVE PROPERTIES, ICE SALINITY, PRESSURE RIDGES, ICE LOADS, ICE CONDITIONS, OFFSHORE STRUCTURES.

MP 1809
ICE SEGREGATION AND FROST HEAVING.

National Research Council. Ad Hoc Study Group on Ice Segregation and Frost Heaving, Washington, D.C., National Academy Press, 1984, 72p., Refs. p.37-72.
39-1042
FROST HEAVE, GROUND ICE, ICE LENSES, ICE FORMATION, COLD WEATHER CONSTRUCTION, SEASONAL FREEZE THAW, UNFROZEN WATER CONTENT, PHASE TRANSFORMATIONS, HEAT TRANSFER, MODELS.

MP 1810
TERTIARY CREEP MODEL FOR FROZEN SANDS (DISCUSSION).

Fish, A.M., et al, *Journal of geotechnical engineering*, Sep. 1984, 110(9), p.1373-1378, 7 refs. For paper being discussed see 37-3969.
Assur, A.
39-1038
FROZEN GROUND MECHANICS, SOIL CREEP, SANDS, STRAINS, MATHEMATICAL MODELS.

MP 1811
MIZEX 83 MESOSCALE SEA ICE DYNAMICS: INITIAL ANALYSIS.

Hibler, W.D., III, et al, *U.S. Army Cold Regions Research and Engineering Laboratory. Special report*, Sep. 1984, SR 84-28, p.19-28, ADA-148 255, 3 refs.
Leppäranta, M.
39-1126
ICE MECHANICS, SEA ICE, STRAINS, ICE CONDITIONS, ICE DEFORMATION, ICE FLOES, ICE EDGE.

MP 1812
ON THE RHEOLOGY OF A BROKEN ICE *FIELD DUE TO FLOE COLLISION*.

Shen, H., et al, *U.S. Army Cold Regions Research and Engineering Laboratory. Special report*, Sep. 1984, SR 84-28, p.29-34, ADA-148 255, 6 refs.
Hibler, W.D., III, Leppäranta, M.
39-1127
ICE MECHANICS, RHEOLOGY, ICE FLOES, INTERFACES, *STRESSES*, ICE CREEP, ICE EDGE, *MATHEMATICAL* MODELS, VELOCITY.

MP 1813
ICE JAM RESEARCH NEEDS.

Gerard, R., Workshop on Hydraulics of River Ice, 3rd, Fredericton, New Brunswick, Canada, June 20-21, 1984. Proceedings. Compiled by K.S. Davar and B.C. Burrell, Fredericton, University of New Brunswick, [1984], p.181-193, With French summary. Discussion p.*192-193*.
39-1463
ICE JAMS, FREEZEUP, ICE BREAKUP, ICE FORMATION, RIVER ICE, FRAZIL ICE, MODELS, CANADA—NORTHWEST TERRITORIES—MACKENZIE RIVER.

Suggestions developed by the NRCC Working Group on Ice Jams for high priority research needs for ice jams are given. The suggestions concern ice jam formation, development and failure at freeze-up and break-up. Related processes such as frazil formation, hanging dams and ice deterioration were excluded from consideration. It is concluded that, despite significant progress in the past two decades, the work of developing a real understanding of ice jam fundamentals has really only just begun.

MP 1814

COMPUTER SIMULATION OF ICE COVER FORMATION IN THE UPPER ST. LAWRENCE RIVER.

Shen, H.T., et al, Workshop on Hydraulics of River Ice, 3rd, Fredericton, New Brunswick, Canada, June 20-21, 1984. Proceedings. Compiled by K.S. Davar and B.C. Burrell, Fredericton, University of New Brunswick, [1984], p.227-245, With French summary., Discussion p.245. 23 refs.
Yapa, P.D.
39-1466
ICE FORMATION, ICE COVER THICKNESS, RIVER ICE, RIVER FLOW, HEAT TRANSFER, ICE JAMS, HYDRAULICS, COMPUTERIZED SIMULATION, ANALYSIS (MATHEMATICS), CANADA—SAINT LAWRENCE RIVER.

A computer model was developed for simulating the formation of ice cover in the Upper St. Lawrence River. The model included submodels for the river flow condition, the distribution of water temperature or frazil ice production, and the formation of an ice cover. Distributions of water temperature or ice production are determined by a Lagrangian solution of the equation for the transport of thermal energy subject to surface heat exchange. The formation of an ice cover and ice accumulations is formulated according to existing equilibrium ice jam theories. The hydraulic condition in the river system is determined by an implicit numerical solution of unsteady continuity and momentum equations.

MP 1815

NUMERICAL SIMULATION OF FREEZE-UP ON THE OTTAUQUECHEE RIVER.

Calkins, D.J., Workshop on Hydraulics of River Ice, 3rd, Fredericton, New Brunswick, Canada, June 20-21, 1984. Proceedings. Compiled by K.S. Davar and B.C. Burrell, Fredericton, University of New Brunswick, [1984], p.247-277, With French summary., Discussion p.275-277. 18 refs.
39-1467
FREEZEUP, RIVER ICE, RIVER FLOW, METEOROLOGICAL FACTORS, HYDRAULICS, ICE MECHANICS, MATHEMATICAL MODELS, WATER LEVEL, ICE EDGE, ICE COVER THICKNESS, ICE JAMS, HEAT TRANSFER, UNITED STATES—VERMONT—OTTAUQUECHEE RIVER.

A numerical model of the flow and ice conditions during freeze-up for the Ottauquechee River has been developed and calibrated with reasonable success. A limited sensitivity analysis of the key ice hydraulic modeling coefficients and independent variables was undertaken to examine their effect on the rate of leading edge progression, ice thicknesses and water levels. The criteria for advancement of the leading edge were based on both the entrainment velocity of incoming frazil slush at the leading edge and whether or not the flow condition was sub-critical just upstream of the leading edge. The depositional mode of ice thickening accounted for over 50% of the total ice thickness in the steep reaches and over 80% in 1 km of the pool. The simulation suggests that the initial ice cover thickness during progression can be predicted using the equilibrium ice jam theory with a suitable cohesion coefficient. The inflow ice discharge and ice generated within the reach modeled were important and have to be known with reasonable accuracy to get good simulations of the ice thicknesses, water levels and ice cover progression.

MP 1816

RISE PATTERN AND VELOCITY OF FRAZIL ICE.

Wuebben, J.L., Workshop on Hydraulics of River Ice, 3rd, Fredericton, New Brunswick, Canada, June 20-21, 1984. Proceedings. Compiled by K.S. Davar and B.C. Burrell, Fredericton, University of New Brunswick, [1984], p.297-316, With French summary., Discussion p.315-316. 3 refs.
39-1469
FRAZIL ICE, RIVER ICE, ICE MECHANICS, VELOCITY, TESTS, ARTIFICIAL ICE.

The objective of this study was to examine the rise pattern and velocity of frazil ice. In addition, discs made of other materials were employed both to facilitate this study and to aid in the development of artificial frazil for future transport studies. The rise velocity is a parameter important to the understanding of frazil entrainment, transport and deposition. Laboratory tests were conducted in a large clear plastic cylinder at controlled temperatures. The rise velocity of real frazil is compared with theory and given an indirect verification that the preferential crystal growth direction increases disc diameter while the thickness remains essentially constant. The effective drag coefficients and rise pattern stability are discussed in terms of a Reynolds-Strouhal number relationship. The results from real and artificial frazil experiments are compared, and criteria for frazil simulation are suggested.

MP 1817

RADAR MEASUREMENTS OF BOREHOLE GEOMETRY ON THE GREENLAND AND ANTARCTIC ICE SHEETS.

Jezek, K.C., *Geophysics,* Feb. 1985, 50(2), p.247-251, 12 refs.
39-1749
GLACIER FLOW, RADAR ECHOES, BOREHOLES, ICE SHEETS, ICE MECHANICS, GLACIER OSCILLATION, GREENLAND, ANTARCTICA—DOME C.

A method for measuring the geometry of boreholes in glaciers has been developed and tested in Greenland and Antarctica. Coordinates of points along the borehole are determined by lowering a passive radar target into the borehole and then tracking the target from three surface stations. Comparison of geometry interpreted from radar data and from a conventional inclinometry experiment indicates that radar data can be used to estimate average borehole inclination and azimuth but cannot be used to measure details of the borehole geometry that are revealed by conventional inclinometry surveys. Random error introduced by variations in the physical properties of the glacier and electrical noise in the radar unit limit measurement accuracy, but the accuracy can be improved by establishing additional surface radar stations around the borehole. These experiments demonstrate the utility of the radar method and suggest the possibility of deploying permanently installed radar targets in ice sheets to measure intraglacial movements. (Auth.)

MP 1818

WEST ANTARCTIC SEA ICE.

Ackley, S.F., Environment of West Antarctica: potential CO2-induced changes; report of a workshop, July *1983, Washington, D.C., 1984, p.88-95, PB85-110* 757, 14 refs.
39-1502
SEA ICE, ICE COVER EFFECT, CLIMATIC CHANGES, CARBON DIOXIDE, HEAT TRANSFER, ANTARCTICA—AMUNDSEN SEA, ANTARCTICA—ROSS SEA.

In constructing models for predicting antarctic sea ice effect on global climate, temperature and wind fields over and below the pack ice must be analyzed. These elements affect the maximum extent of the ice pack and the ice dynamics in the pack strongly modulates the CO2-induced temperature rises. These factors are discussed in text and diagrams.

MP 1819

TRANSPORT OF WATER IN FROZEN SOIL: 5, METHOD FOR MEASURING THE VAPOR DIFFUSIVITY WHEN ICE IS ABSENT.

Nakano, Y., et al, *Advances in water resources,* Dec. 1984, Vol.7, p.172-179, 12 refs.
Tice, A.R., Jenkins, T.F.
39-1719
FROZEN GROUND, SOIL WATER MIGRATION, WATER TRANSPORT, VAPOR DIFFUSION, EXPERIMENTATION.

A new experimental method is introduced for determining the relative magnitudes of liquid and vapor diffusion by using a small amount of soluble chemical as a tracer. The theoretical justification of the method is presented for the case where ice is absent. The feasibility of the method is demonstrated by an experiment using marine-deposited clay.

MP 1920

LONG-TERM EFFECTS OF OFF-ROAD VEHICLE TRAFFIC ON TUNDRA TERRAIN.

Abele, G., et al, *Journal of terramechanics,* 1984, 21(3), p.283-294, 10 refs.
Brown, J., Brewer, M.C.
39-1586
AIR CUSHION VEHICLES, TRACKED VEHICLES, TUNDRA, DAMAGE, ACTIVE LAYER, VEGETATION, PERMAFROST, ENVIRONMENTAL IMPACT, THAW DEPTH, TESTS.

Traffic tests were conducted at two sites in northern Alaska with an air cushion vehicle, two light tracked vehicles, and three types of wheeled Rolligon vehicles. The traffic impact (surface depression, effect on thaw depth, damage to vegetation, traffic signature visibility) was monitored for periods of up to 10 years. Data show the immediate and long-term effects from the various types of vehicles for up to 50 traffic passes and the rates of recovery of the active layer. The air cushion vehicle produced the least impact. Multiple passes with the Rolligons caused longer-lasting damage than the light tracked vehicles because of their higher ground contact pressure and wider area of disturbance. Recovery occurs even if the initial depression of the tundra surface by a track or a wheel is quite deep (15 cm), as long as the organic mat is not sheared or destroyed.

MP 1821

DISCUSSION: ELECTROMAGNETIC PROPERTIES OF SEA ICE BY R.M. MOREY, A. KOVACS AND G.F.N. COX.

Arcone, S.A., *Cold regions science and technology,* Nov. 1984, 10(1), p.93-94, For paper being discussed see 39-332 (MP 1776). 1 ref.
39-1626
ICE ELECTRICAL PROPERTIES, ELECTROMAGNETIC PROPERTIES, SEA ICE, ICE RELAXATION.

MP 1822

AUTHORS' RESPONSE TO DISCUSSION ON: ELECTROMAGNETIC PROPERTIES OF SEA ICE.

Morey, R.M., et al, *Cold regions science and technology,* Nov. 1984, 10(1), p.95-97, For original paper see 39-332 (MP 1776); for discussion by S.A. Arcone, see 39-1626 (MP 1821). 1 ref.
Kovacs, A., Cox, G.F.N.
39-1627
ICE ELECTRICAL PROPERTIES, ELECTROMAGNETIC PROPERTIES, SEA ICE, ICE RELAXATION, ELECTRICAL RESISTIVITY.

MP 1823

PROBABILITY MODELS FOR ANNUAL EXTREME WATER-EQUIVALENT GROUND SNOW.

Ellingwood, B., et al, *Monthly weather review,* June 1984, 112(6), p.1153-1159, 12 refs.
Redfield, R.K.
39-1740
SNOW WATER EQUIVALENT, SNOW LOADS, *ROOFS, STATISTICAL ANALYSIS, DESIGN.*

A statistical analysis of annual extreme water-equivalents of ground snow (reported as inches of water) measured up through the winter of 1979-80 at 76 weather stations in the northeast quadrant of the United States is presented. The analysis suggests that probability distributions with longer upper tails than the Type I distribution of extreme values are preferable for describing the annual extremes at a majority of sites. Sampling errors and the selection of water-equivalents for planning and design purposes also are described.

MP 1824

ICE FLOW LEADING TO THE DEEP CORE HOLE AT DYE 3, GREENLAND.

Whillans, I.M., et al, *Annals of glaciology,* 1984, Vol.5, p.185-190, 12 refs.
Jezek, K.C., Drew, A.R., Gundestrup, N.
39-196
ICE MECHANICS, RHEOLOGY, BOREHOLES, ICE BOTTOM SURFACE, RADIO ECHO SOUNDINGS, ICE COVER THICKNESS, VELOCITY, GREENLAND.

MP 1825

LABORATORY INVESTIGATION OF THE KINETIC FRICTION COEFFICIENT OF ICE.

Forland, K.A., et al, IAHR International Symposium on Ice, 7th, Hamburg, F.R.G., Aug. 27-31, 1984. Proceedings, Vol.1, [1984], p.19-28, 11 refs.
Tatinclaux, J.C.
39-1752
ICE FRICTION, ICE LOADS, ICE MECHANICS, ICE HARDNESS, ICE SOLID INTERFACE, SURFACE ROUGHNESS, EXPERIMENTATION, TEMPERATURE EFFECTS, SHEAR STRESS.

In the growing field of ice engineering there is a need to establish standardized model tests of structures for use in environments. This study was designed to investigate the relative influence of various parameters on the kinetic friction coefficient between ice and different surfaces and determine which of those variables would need future, in-depth investigation. Friction tests were performed with urea-doped, columnar ice, and the parameters of normal pressure, velocity, type of material, material roughness, ice hardness and test configuration were studied. Tests were conducted by pulling a loaded sample of ice over a sheet of material and by pulling a loaded sample of material over an ice sheet. An ambient temperature of -1.5C was maintained throughout the testing process, and the ice surface hardness was measured using a specially designed apparatus. The experimental results of the friction tests revealed that the behavior of the friction coefficient with varying velocity was significantly influenced by the test configuration and material roughness. Its magnitude was also affected by varying normal pressure, ice hardness, surface roughness and type of material.

MP 1826

FLEXURAL STRENGTHS OF FRESHWATER MODEL ICE.

Gow, A.J., IAHR International Symposium on Ice, 7th, Hamburg, F.R.G., Aug. 27-31, 1984. Proceedings, Vol.1, [1984], p.73-82, 4 refs.
39-1757
ICE STRENGTH, FLEXURAL STRENGTH, LAKE ICE, ICE CRYSTAL STRUCTURE, ICE *TEMPERATURE, GRAIN SIZE, TESTS.*

In this paper we present results of small beam tests performed on simulated lake ice corresponding in structure to the two major ice types, S1 and S2, encountered in lake ice covers. In these tests a combination of cantilever and simply supported beams was used to ascertain the dependence of flexural strength of the ice on its structure and temperature. It was found that macrocrystalline (S1) ice and columnar (S2) ice exhibit significant differences in bending strength and that substantial stress concentrations exist at the fixed corners of cantilever beams. Differences in response of S1 and S2 ice to bending forces clearly reflect variations in grain size, crystal orientation, temperature, and temperature gradient in the simulated ice, and these factors must be carefully considered when interpreting results of tests of the flexural strength of natural ice covers.

MP 1827

ICEBREAKING BY GAS BLASTING.

Mellor, M., IAHR International Symposium on Ice, 7th, Hamburg, F.R.G., Aug. 27-31, 1984. Proceedings, Vol.1, ₍1984₎, p.93-102, 6 refs.

39-1759

ICE BLASTING, ICE BREAKING, HIGH PRESSURE TESTS, ICE COVER THICKNESS, GASES, TESTS, ICE LOADS, HYDRAULIC STRUCTURES, EQUIPMENT.

Icebreaking tests utilizing high pressure air and CO(2), low pressure air, and fuel/oxidant combustion are reviewed and the results are interpreted. Applying cube root energy scaling to test discharges of approximately 1 MJ, it appears that fracture craters up to about 5.8 m/MJ(1/3) in diameter can be formed by optimum underwater blasts. Practical systems for clearing or displacing ice could be based on air guns developed for offshore seismic work, with gun pressure in the range 17-20 MPa and single-gun energy up to about 11 MJ. A procedure for making preliminary design calculations and safety appraisals is outlined, and it is concluded that a working "Super-Bubbler" need not be very complex or expensive.

MP 1828

QUIET FREEZING OF LAKES AND THE CONCEPT OF ORIENTATION TEXTURES IN LAKE ICE SHEETS.

Gow, A.J., IAHR International Symposium on Ice, 7th, Hamburg, F.R.G., Aug. 27-31, 1984. Proceedings, Vol.1, ₍1984₎, p.137-149, 6 refs.

39-1763

LAKE ICE, ICE CRYSTAL STRUCTURE, ICE NUCLEI, FREEZING, TURBULENCE, TESTS.

Several years' observations of the crystalline structure of ice sheets forming on a number of New England lakes indicate that just two major types of congelation ice are formed during quiet (non-turbulent) freezing of lake water. These are: (1) ice sheets characterized by the growth of massive prismatic crystals exhibiting vertical or near-vertical c-axes probably equivalent to so-called S1 ice and (2) ice sheets composed predominantly of vertically elongated crystals exhibiting horizontally oriented c-axes, so-called columnar ice or S2 ice. In this context of quiet freezing of lakes it was also determined that columnar textures are always associated with horizontal c-axis orientations of the crystals, whereas the development of c-axis vertical orientation is invariably linked with the growth of massive crystals. These observations have fostered the concept of orientation textures.

MP 1829

DYNAMICS OF FRAZIL ICE FORMATION.

Daly, S.F., et al, IAHR International Symposium on Ice, 7th, Hamburg, F.R.G., Aug. 27-31, 1984. Proceedings, Vol.1, ₍1984₎, p.161-172, 10 refs.

Stolzenbach, K.D.

39-1765

FRAZIL ICE, ICE CRYSTAL GROWTH, HEAT TRANSFER, MATHEMATICAL MODELS, MASS TRANSFER, SURFACE PROPERTIES, ICE CRYSTAL NUCLEI.

This paper applies quantitative approaches of large-scale industrial crystallization to the study of frazil ice. The development of a crystal number continuity equation and a heat conservation equation can serve as a basis for predicting size distribution and concentration of frazil crystals. The key parameters in these equations are the crystal growth rate and the rate of secondary nucleation. The crystal growth rate is determined by the heat transfer rate from the crystals to the fluid, the intrinsic kinetics of the crystals, surface tension, and the mass transfer rates. Available data indicate that the growth of the major axis of frazil crystals is controlled largely by heat transfer. The heat transfer expression for disks suspended in turbulent flow is presented. The rate of secondary nucleation can be expressed as the product of three functions, which relate the energy transferred to crystals by collision and the number of surviving crystals produced by the collision. The secondary nucleation rate is found to be a function of the turbulent energy dissipation and a strongly nonlinear function of the form and magnitude of the crystal size distribution. The number continuity and heat conservation equations are troublesome to solve simultaneously because they are nonlinear and dimensionally incompatible. However, the equations can be used in the development of models of frazil ice formation.

MP 1830

FIELD INVESTIGATION OF ST. LAWRENCE RIVER HANGING ICE DAMS.

Shen, H.T., et al, IAHR International Symposium on Ice, 7th, Hamburg, F.R.G., Aug. 27-31, 1984. Proceedings, Vol.1, ₍1984₎, p.241-249, 12 refs.

Van DeValk, W.A.

39-1772

ICE DAMS, RIVER ICE, ICE SURVEYS, RIVER FLOW, CHANNELS (WATERWAYS), BOTTOM TOPOGRAPHY, CANADA—SAINT LAWRENCE RIVER.

A field survey of a hanging ice dam in the St. Lawrence River is reported. Cross section profiles of the dam, the channel geometry, and velocity profiles underneath the dam were measured. Formation processes of hanging dams are discussed and supported by field observations.

MP 1831

METHODS OF ICE CONTROL FOR WINTER NAVIGATION IN INLAND WATERS.

Frankenstein, G.E., et al, IAHR International Symposium on Ice, 7th, Hamburg, F.R.G., Aug. 27-31, 1984. Proceedings, Vol.1, ₍1984₎, p.329-337, 11 refs.

Wortley, C.A.

39-1780

ICE NAVIGATION, ICE CONTROL, RIVER ICE, PORTS, WINTER MAINTENANCE, ICE BREAKING, THERMAL EFFECTS, ICE REMOVAL, ICE BOOMS.

Successful methods of controlling ice in rivers and harbors where winter navigation is maintained are described. These methods are developed from field and laboratory research studies and from operating experiences. The control of ice is achieved through layout and design of harbor facilities, management of traffic operations, and by using chemical, electrical, mechanical, and thermal methods including ice breaking, channel and flow modifications, air bubbling, warm water discharges, resistance heating, coatings, and control structures. The control methods used must be evaluated in terms of reliability, safety, energy consumption, and environmental impact for costs and effectiveness for both docks and harbors. Thermal methods and mechanical methods are most favored by these criteria.

MP 1832

ICE SHEET RETENTION STRUCTURES.

Perham, R.E., IAHR International Symposium on Ice, 7th, Hamburg, F.R.G., Aug. 27-31, 1984. Proceedings, Vol.1, ₍1984₎, p.339-348, 20 refs.

39-1781

ICE CONTROL, STRUCTURES, ICE SHEETS, ICE BOOMS, ICE FORMATION, ICE COVER, COUNTERMEASURES, WATER FLOW.

Ice sheets are formed and retained in several ways in nature, and an understanding of these factors is needed before most ice sheet retention structures can be successfully applied. Many retention structures float and are somewhat flexible; others are fixed and rigid or semirigid. An example of the former is the Lake Erie boom and of the latter, the Montreal ice control structure. Ice sheet retention technology is changing. The use of timber cribs is gradually but not totally giving way to sheet steel pilings and concrete cells. New structures and applications are being tried, but with caution. Ice-hydraulic analyses are helpful in predicting the effects of structures and channel modifications on ice cover formation and retention. Often, varying the flow rate in a particular system at the proper time will make the difference between whether a structure will or will not retain ice. The structure, however, invariably adds reliability to the sheet ice retention process.

MP 1833

ANALYSIS OF RAPIDLY VARYING FLOW IN ICE-COVERED RIVERS.

Ferrick, M.G., IAHR International Symposium on Ice, 7th, Hamburg, F.R.G., Aug. 27-31, 1984. Proceedings, Vol.1, ₍1984₎, p.359-368, 6 refs.

39-1783

RIVER FLOW, RIVER ICE, ICE COVER EFFECT, ICE BREAKUP, WATER WAVES, FRICTION, EXPERIMENTATION, ICE JAMS, ICEBOUND RIVERS.

Rapidly varying flow waves are a primary cause of ice cover breakup on rivers. Due to the presence of ice and the difficulties involved in determining conditions in the field, analyses of river waves during breakup are subject to much uncertainty. We conducted laboratory experiments to determine the effects of the ice cover upon these waves, and to identify the physical processes that produce these effects. The dimensionless friction scaling parameter of the St. Venant equations provides a quantitative estimate of the friction/inertia balance that dictates river wave behavior. Knowledge of this balance is essential to interpretation and analysis of flow wave data. In this paper we apply the friction parameter in our interpretation of the laboratory data and address discrepancies between data and previous analyses of an ice jam release on the Athabasca River.

MP 1834

CRUSHING ICE FORCES ON CYLINDRICAL STRUCTURES.

Morris, C.E., et al, IAHR International Symposium on Ice, 7th, Hamburg, F.R.G., Aug. 27-31, 1984. Proceedings, Vol.2, ₍1984₎, p.1-9, 19 refs.

Sodhi, D.S.

39-1787

ICE PRESSURE, STRUCTURES, ICE SOLID INTERFACE, COMPRESSIVE PROPERTIES, ICE COVER THICKNESS, PILES, ICE LOADS, ICE STRENGTH, VELOCITY, EXPERIMENTATION.

The parameters varied during the experimental program were structure diameter and velocity. Maximum ice forces were normalized by the product of structure diameter, ice thickness and unconfined compressive strength of the ice. The results show that ice forces depend significantly on aspect ratio and velocity-to-thickness ratio, and that variations in velocity-to-structure-diameter ratio does not influence the maximum normalized forces.

MP 1835

CRYSTALLINE STRUCTURE OF UREA ICE SHEETS USED IN MODELING IN THE CRREL TEST BASIN.

Gow, A.J., IAHR International Symposium on Ice, 7th, Hamburg, F.R.G., Aug. 27-31, 1984. Proceedings, Vol.2, ₍1984₎, p.241-253, 13 refs.

39-1807

ICE CRYSTAL STRUCTURE, UREA, ARTIFICIAL ICE, MICROSTRUCTURE, ICE MODELS, SEA ICE, ICE STRENGTH, ICE SHEETS, TESTS.

Standard petrographic techniques were used for studying microstructure in thin sections of urea ice sheets now being used extensively in the CRREL Test Basin for modeling sea ice. Depending mainly on the seeding techniques employed and partly on the thermal condition in the column of urea-doped water two kinds of ice with radically different structural and mechanical properties have been identified. In the one exhibiting vertical c-axis structure minimal urea is incorporated into the ice crystals, and ice sheets with this kind of structure tend to remain "strong" even after the temperature of the ice is raised close to its melting point. Ice of the second type is characterized by a preponderance of crystals exhibiting horizontal c-axes. This kind of ice, which is only produced when the test basin is seeded prior to freezing, also contains abundant inclusions of urea systematically incorporated into the crystals; the overall columnar structure of this ice closely resembles that of ordinary sea ice and optimum test conditions for modeling purposes are usually obtained with warm isothermal ice sheets of the latter type.

MP 1836

EVALUATION OF A BIAXIAL ICE STRESS SENSOR.

Cox, G.F.N., IAHR International Symposium on Ice, 7th, Hamburg, F.R.G., Aug. 27-31, 1984. Proceedings, Vol.2. ₍1984₎, p.349-361.

39-1816

ICE LOADS, STRESSES, MEASURING INSTRUMENTS, TESTS.

Controlled laboratory tests were performed to evaluate the response of a cylindrical, biaxial ice stress sensor. The tests demonstrate that the sensor has a low temperature sensitivity and is not significantly affected by differential thermal expansion between the ice and gauge. Loading tests on fresh water and saline ice blocks containing the embedded sensor show that the sensor has a resolution of 20 kPa and an accuracy of better than 15% under a variety of uniaxial and biaxial loading conditions.

MP 1837

STRUCTURE OF FIRST-YEAR PRESSURE RIDGE SAILS IN THE PRUDHOE BAY REGION.

Tucker, W.B., et al, Alaskan Beaufort Sea: ecosystems and environments. Edited by P.W. Barnes, D.M. Schell and E. Reimnitz, Orlando, FL, Academic Press, 1984, p.115-135, 25 refs.

Sodhi, D.S., Govoni, J.W.

39-1873

PRESSURE RIDGES, ICE STRUCTURE, SEA ICE, ICE COVER THICKNESS, ICE SHEETS, MODELS, ICE PILEUP, UNITED STATES—ALASKA—PRUDHOE BAY.

MP 1838

SOME PROBABILISTIC ASPECTS OF ICE GOUGING ON THE ALASKAN SHELF OF THE BEAUFORT SEA.

Weeks, W.F., et al, Alaskan Beaufort Sea: ecosystems and environments. Edited by P.W. Barnes, D.M. Schell and E. Reimnitz, Orlando, FL, Academic Press, 1984, p.213-236, 23 refs.

Barnes, P.W., Rearic, D.M., Reimnitz, E.

39-1877

ICE SCORING, PRESSURE RIDGES, BOTTOM TOPOGRAPHY, OCEAN BOTTOM, STATISTICAL ANALYSIS, OFFSHORE STRUCTURES, DESIGN, BOTTOM SEDIMENT, PIPELINES, BEAUFORT SEA.

MP 1839

DETERMINING DISTRIBUTION PATTERNS OF ICE-BONDED PERMAFROST IN THE U.S. BEAUFORT SEA FROM SEISMIC DATA.

Neave, K.G., et al, Alaskan Beaufort Sea: ecosystems and environments. Edited by P.W. Barnes, D.M. Schell and E. Reimnitz, Orlando, FL, Academic Press, 1984, p.237-258, 24 refs.
Sellmann, P.V.
39-1878
SUBSEA PERMAFROST, SEISMIC VELOCITY, PERMAFROST DISTRIBUTION, EXPLORATION, CRUDE OIL, SEISMIC REFRACTION, *VELOCITY, TEMPERATURE DISTRIBUTION,* DETECTION, BEAUFORT SEA.

MP 1840

USE OF SIMILARITY SOLUTIONS FOR THE PROBLEM OF A WETTING FRONT—A QUESTION OF UNIQUE REPRESENTATION.

Nakano, Y., *Advances in water resources,* Sep. 1982, Vol.5, p.156-166, 30 refs.
39-1937
SEEPAGE, WATER, POROUS MATERIALS, SOIL PHYSICS, SOIL WATER MIGRATION, FLOW RATE, ANALYSIS (MATHEMATICS).

The use of similarity solutions for the problem of horizontal infiltration of water into a semi-infinite, dry and homogeneous porous medium is studied based upon some recent results of functional analysis. It is found that the so-called non-unique representation of reported experimental moisture profiles for this problem is not necessarily evidence against the validity of the extended Darcy's law for unsaturated flow through porous media.

MP 1841

TRANSPORT OF WATER IN FROZEN SOIL: 3. EXPERIMENTS ON THE EFFECTS OF ICE CONTENT.

Nakano, Y., et al, *Advances in water resources,* Mar.1984, Vol.7, p.28-34, 5 refs.
Tice, A.R., *Oliphant, J.L.*
39-1945
WATER TRANSPORT, FROZEN GROUND, GROUND ICE, SOIL WATER MIGRATION, WATER VAPOR, WATER CONTENT, EXPERIMENTATION.

Effects of ice content on the transport of water in frozen soil are studied experimentally and theoretically under isothermal conditions. A physical law, that the flux of water in unsaturated frozen soil is proportional to the gradient of total water content, is proposed. Theoretical justification is made by the use of the two-phase flow theory. The experimental results are shown to support the proposed physical law. The results of this study are presented in two parts. *The experimental aspects of the study are presented in this* paper and the second paper contains the theoretical aspects of the study.

MP 1842

ROLE OF HEAT AND WATER TRANSPORT IN FROST HEAVING OF FINE-GRAINED POROUS MEDIA UNDER NEGLIGIBLE OVERBURDEN PRESSURE.

Nakano, Y., et al, *Advances in water resources,* June 1984, Vol.7, p.93-102, 18 refs.
Horiguchi, K.
39-1936
FROST HEAVE, HEAT TRANSFER, WATER *TRANSPORT, SOIL WATER MIGRATION,* POROUS MATERIALS, WATER INTAKES, GRAIN SIZE, FINES.

An equation accurately describing the rate of frost heave is derived by using the mixture theory of continuum mechanics. It is shown that the rate of frost heave is determined mainly by the rate of heat removal and the rate of water intake. When the phase equilibrium holds in the system, the relation between the rate of heat removal and the rate of water intake is shown to depend mainly on the phase composition data of a given medium. By studying reported experimental data, it is found that the phase equilibrium may hold until the rate of heat removal reaches a certain critical value. When the rate of heat removal exceeds this critical value, the phase equilibrium may possibly be disrupted for some media.

MP 1843

TRANSPORT OF WATER IN FROZEN SOIL: 4. ANALYSIS OF EXPERIMENTAL RESULTS ON THE EFFECTS OF ICE CONTENT.

Nakano, Y., et al, *Advances in water resources,* June 1984, Vol.7, p.58-66, 19 refs.
Tice, A.R., Oliphant, J.L.
39-1946
WATER TRANSPORT, FROZEN GROUND, GROUND ICE, SOIL WATER MIGRATION, DIFFUSION, ANALYSIS (MATHEMATICS).

Effects of ice content on the transport of water in frozen soil are studied experimentally and theoretically under isothermal conditions. A physical law, that the flux of water in unsaturated frozen soil is proportional to the gradient of total water content is proposed. Theoretical justification is made by the use of the two-phase flow theory. The experimental results are shown to support the proposed physical law. The results of this study are presented in two parts and this is the second paper describing the theoretical aspects of the study.

MP 1844

RHEOLOGY OF GLACIER ICE.

Jezek, K.C., et al, *Science,* Mar. 15, 1985, 227(4692), p.1335-1337, 13 refs.
Alley, R.B., Thomas, R.H.
39-1942
GLACIER ICE, RHEOLOGY, ICE SHELVES, STRAINS, ICE MECHANICS, ANTARCTICA—ROSS ICE *SHELF.*

A new method for calculating the stress field in bounded ice shelves is used to compare strain rate and deviatoric stress on the Ross Ice Shelf, Antarctica. The analysis shows that strain rate (per second) increases as the third power of deviatoric stress (in newtons per square meter), with a constant of proportionality equal to 2.3 x 10 to the -25th power. (Auth.)

MP 1845

SITE-SPECIFIC AND SYNOPTIC METEOROLOGY.

Bates, R.E., *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* June 1983, SR 83-16, SNOW-ONE-B data report, p.13-80, ADB-088 224.
39-1952
SYNOPTIC METEOROLOGY, SNOWFALL, METEOROLOGICAL DATA, SNOW COVER, SNOW CRYSTAL STRUCTURE, WIND VELOCITY, AIR MASSES, STATISTICAL ANALYSIS.

MP 1846

ATMOSPHERIC TURBULENCE MEASUREMENTS AT SNOW-ONE-B.

Andreas, E.L., *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* June 1983, SR 83-16, SNOW-ONE-B data report, p.81-87, ADB-088 224.
39-1953
ATMOSPHERIC CIRCULATION, SNOWFALL, SPECTRA, REFRACTION, TURBULENCE, ELECTROMAGNETIC PROPERTIES, MEASURING INSTRUMENTS.

MP 1847

SNOW CHARACTERIZATION AT SNOW-ONE-B.

Berger, R.H., et al, *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* June 1983, SR 83-16, SNOW-ONE-B data report, p.155-195, ADB-088 224, 2 refs.
Fisk, D., Koh, G., Lacombe, J.
39-1955
ICE CRYSTAL STRUCTURE, SNOW CRYSTAL STRUCTURE, SNOW CRYSTAL GROWTH, SNOW COVER DISTRIBUTION, PARTICLE SIZE DISTRIBUTION, SNOWFALL, TEMPERATURE EFFECTS, HUMIDITY, STATISTICAL ANALYSIS.

MP 1848

SUMMARY OF THE STRENGTH AND MODULUS OF ICE SAMPLES FROM MULTI-YEAR PRESSURE RIDGES.

Cox, G.F.N., et al, *Journal of energy resources technology,* Mar. 1985, 107(1), p.93-98, 14 refs. For another source see 38-2035.
Richter, J.A., Weeks, W.F., Mellor, M.
39-2082
PRESSURE RIDGES, ICE STRENGTH, COMPRESSIVE PROPERTIES, STRAINS, TEMPERATURE EFFECTS, POROSITY, TESTS.

Over two hundred unconfined compression tests were performed on vertical ice samples obtained from 10 multi-year pressure ridges in the Beaufort Sea. The tests were performed on a closed-loop electrohydraulic testing machine at two strain rates 1/100,000 and 1/1,000/s and two temperatures (-20 and -5C). This paper summarizes the sample preparation and testing techniques used in the investigation and presents data on the compressive strength and initial tangent modulus of the ice.

MP 1849

PRELIMINARY EXAMINATION OF THE EFFECT OF STRUCTURE ON THE COMPRESSIVE STRENGTH OF ICE SAMPLES FROM *MULTI-YEAR PRESSURE RIDGES.*

Richter, J.A., et al, *Journal of energy resources technology,* Mar. 1985, 107(1), p.99-102, 9 refs. For another source see 38-2037 (MP 1685).
Cox, G.F.N.
39-2083
PRESSURE RIDGES, ICE CRYSTAL STRUCTURE, ICE STRENGTH, COMPRESSIVE PROPERTIES, STRAINS, SEA ICE, TEMPERATURE EFFECTS, POROSITY, TESTS.

A series of 222 uniaxial constant-strain-rate compression tests was performed on vertical multi-year pressure ridge sea ice samples. A preliminary analysis of the effect of structure on the compressive strength of the ice was performed on 78 of these tests. Test parameters included a temperature of -5C (23F) and strain rates of 1/100,000 and 1/1,000/s. Columnar ice loaded parallel to the elongated crystal axes and perpendicular to the crystal c-axis was consistently the strongest type of ice. The strength of the columnar samples decreased significantly as the orientation of the elongated crystals approached the plane of maximum shear. Samples containing granular ice or a mixture of granular and columnar ice resulted in intermediate and low strength values. No clear relationship could be established between structure and strength for these ice types. However, in general, their strength decreased with an increase in porosity.

MP 1850

DESIGN AND PERFORMANCE OF WATER-RETAINING EMBANKMENTS IN PERMAFROST.

Sayles, F.H., International Conference on Permafrost, 4th, Fairbanks, Alaska, July 17-22, 1983. Final proceedings, Washington, D.C., National Academy Press, 1984, p.31-42, Refs. p.40-42.
39-2124
PERMAFROST BENEATH STRUCTURES, WATER RETENTION, DAMS, GROUND THAWING, FREEZE THAW CYCLES, EMBANKMENTS, MAINTENANCE, DESIGN, PERMA*FROST THERMAL PROPERTIES, ARTIFICIAL* FREEZING, SOIL FREEZING, COLD WEATHER CONSTRUCTION.

To date, the water-retaining structures constructed and maintained on permafrost in North America have been designed and built using a combination of soil mechanics principles for unfrozen soils and unproven permafrost theory. In the USSR, at least five sizeable hydroelectric and water supply embankment dams as well as several small water supply embankment dams have been constructed and maintained on permafrost. The larger dams are understood to have performed well, but the smaller dams have been a mix of successes and failures. Specific criteria are still lacking for design, operation, and post-construction monitoring of water-retaining embankments founded on permafrost. The purpose of this presentation is to review the current practice, point out how it is deficient, and note what major problems need attention.

MP 1851

STATUS OF NUMERICAL MODELS FOR HEAT AND MASS TRANSFER IN FROST-SUSCEPTIBLE SOILS.

Berg, R.L., International Conference on Permafrost, 4th, Fairbanks, Alaska, July 17-22, 1983. Final proceedings, Washington, D.C., National Academy Press, 1984, p.67-71, Refs. p.69-71.
39-2130
PERMAFROST THERMAL PROPERTIES, FROST RESISTANCE, HEAT TRANSFER, MASS TRANSFER, THERMAL CONDUCTIVITY, FROST HEAVE, MATHEMATICAL MODELS, HYDRAULICS, LATENT HEAT, MOISTURE TRANSFER, BOUNDARY LAYER.

MP 1852

SUBSEA PERMAFROST DISTRIBUTION ON THE ALASKAN SHELF.

Sellmann, P.V., et al, International Conference on Permafrost, 4th, Fairbanks, Alaska, July 17-22, 1983. Final proceedings, Washington, D.C., National Academy Press, 1984, p.75-82, 30 refs.
Hopkins, D.M.
39-2131
SUBSEA PERMAFROST, PERMAFROST DISTRIBUTION, PERMAFROST THERMAL PROPERTIES, PERMAFROST DEPTH, OCEAN BOTTOM, WATER TEMPERATURE, SHORES, SEISMIC SURVEYS, BOTTOM SEDIMENT, CHUKCHI SEA, BEAUFORT SEA.

MP 1853

LABORATORY TESTS AND ANALYSIS OF THERMOSYPHONS WITH INCLINED EVAPORATOR SECTIONS.

Zarling, J.P., et al, International Offshore Mechanics and Arctic Engineering Symposium, 4th, Dallas, Texas, Feb. 17-21, 1985. Proceedings, Vol.2, New York, American Society of Mechanical Engineers, 1985, p.31-37, 16 refs.
Haynes, F.D.
39-2392
SUBGRADE SOILS, COOLING, EVAPORATION, HEAT TRANSFER, THERMAL CONDUCTIVITY, WIND TUNNELS, WIND VELOCITY, AIR TEMPERATURE, FOUNDATIONS, GRAVEL, ANALYSIS (MATHEMATICS).

Subgrade cooling methods in cold regions include the use of thermosyphons with inclined evaporator sections. This laboratory study was conducted *to* determine the thermal performance characteristics of a thermosyphon. Evaporator inclination angles ranged from 0 to 12 deg from the horizontal. A standard full size thermosyphon, charged with carbon dioxide, was tested in CRREL's atmospheric wind tunnel. Empirical expressions are presented for heat removal rates as a function of wind speed and ambient air temperature for each of the inclined evaporator angles. An approximate analytical method is also presented for foundation thermal design using thermosyphons under buildings with a slab-on-grade foundation. Heat gains from the slab to the thermosyphon as well as the evaporator temperature are presented as functions of time.

MP 1854
FREEZING OF SOIL WITH PHASE CHANGE OCCURRING OVER A FINITE TEMPERATURE ZONE.

Lunardini, V.J., International Offshore Mechanics and Arctic Engineering Symposium, 4th, Dallas, Texas, Feb. 17-21, 1985. Proceedings, Vol.2, New York, American Society of Mechanical Engineers, 1985, p.38-46, 10 refs.
39-2393
SOIL FREEZING, PHASE TRANSFORMATIONS, TEMPERATURE DISTRIBUTION, ANALYSIS (MATHEMATICS), FREEZE THAW CYCLES, UNFROZEN WATER CONTENT, THERMAL CONDUCTIVITY.

While many materials undergo phase change at a fixed temperature, soil systems exhibit a definite zone of phase change. The variation of unfrozen water with temperature causes the soil to freeze or thaw over a finite temperature range. Exact and approximate solutions are given for conduction phase change of plane layers of soil with water contents that vary linearly, quadratically, and exponentially with temperature. The temperature and phase change depths are found to vary significantly from those of the constant temperature or Neumann problem.

MP 1855
DETERMINING THE CHARACTERISTIC LENGTH OF FLOATING ICE SHEETS BY MOVING LOADS.

Sodhi, D.S., et al, International Offshore Mechanics and Arctic Engineering Symposium, 4th, Dallas, Texas, Feb. 17-21, 1985. Proceedings, Vol.2, New York, American Society of Mechanical Engineers, 1985, p.155-159, 6 refs.
Martinson, C.R., Tucker, W.B.
39-2408
FLOATING ICE, ICE SHEETS, ICE COVER THICKNESS, DYNAMIC LOADS, ICE DEFORMATION, VELOCITY, TESTS.

To determine the characteristic length of a floating ice sheet, the deflection of the ice sheet must be measured in response to a known load. Deflection measurements with a deflectometer require reference to a fixed datum. A simple deflection measuring technique is described here that is based on integration of the response of a sensitive slope transducer to a moving load at constant speed. This procedure does not require reference to a fixed datum; instead the gravitational field acts as the datum. The characteristic lengths obtained from the slope-integration method compare very favorably with those obtained from direct measurement of deflections.

MP 1856
TENSILE STRENGTH OF MULTI-YEAR PRESSURE RIDGE SEA ICE SAMPLES.

Cox, G.F.N., et al, International Offshore Mechanics and Arctic Engineering Symposium, 4th, Dallas, Texas, Feb. 17-21, 1985. Proceedings, Vol.2, New York, American Society of Mechanical Engineers, 1985, p.186-193, 20 refs.
Richter-Menge, J.A.
39-2412
PRESSURE RIDGES, ICE STRENGTH, TENSILE PROPERTIES, SEA ICE, STRESS STRAIN DIAGRAMS, TESTS.

Thirty-six constant strain-rate uniaxial tension tests were performed on vertically oriented multi-year pressure ridge samples from the Beaufort Sea. The tests were performed on a closed-loop electro-hydraulic testing machine at two strain rates (1/100000 and 1/1000/s) and two temperatures (-20 and -5C). This paper summarizes the sample preparation and testing techniques used in the investigation and presents data on the tensile strength, initial tangent modulus, and failure strain of the ice.

MP 1857
STRUCTURE, SALINITY AND DENSITY OF MULTI-YEAR SEA ICE PRESSURE RIDGES.

Richter-Menge, J.A., et al, International Offshore Mechanics and Arctic Engineering Symposium, 4th, Dallas, Texas, Feb. 17-21, 1985. Proceedings, Vol.2, New York, American Society of Mechanical Engineers, 1985, p.194-198, 11 refs.
Cox, G.F.N.
39-2413
PRESSURE RIDGES, ICE STRUCTURE, ICE SALINITY, ICE DENSITY, SEA ICE, ICE LOADS, PROFILES, BEAUFORT SEA.

Data are presented on the variation of ice structure, salinity, and density in multi-year pressure ridges from the Beaufort Sea. Two continuous multi-year pressure ridge cores are examined as well as ice sample data from numerous other pressure ridges. The results suggest that the large scale properties of multi-year pressure ridges are not isotropic, and that the use of anisotropic ridge models may result in lower design ridge ice loads.

MP 1858
GRAIN SIZE AND THE COMPRESSIVE STRENGTH OF ICE.

Cole, D.M., International Offshore Mechanics and Arctic Engineering Symposium, 4th, Dallas, Texas, Feb. 17-21, 1985. Proceedings, Vol.2, New York, American Society of Mechanical Engineers, 1985, p.220-226, 15 refs.
39-2416
ICE STRENGTH, COMPRESSIVE PROPERTIES, GRAIN SIZE, STRESS STRAIN DIAGRAMS, TESTS.

This work presents the results of uniaxial compression tests on freshwater polycrystalline ice. Grain size of the test material ranged from 1.5 to 5 mm, strain rate ranged from 1/1,000,000 to 1/100/s and the temperature was -5 C. The grain size effect emerged clearly as the strain rate increased to 1/100,000/s and persisted to the highest applied strain rates. On average, the stated increase in grain size brought about a decrease in peak stress of approximately 31%. The occurrence of the grain size effect coincided with the onset of visible cracking. The strength of the material increased to a maximum at a strain rate of 1/1,000/s, and then dropped somewhat as the strain rate increased further to 1/100/s. Strain at peak stress generally tended to decrease with both increasing grain size and increasing strain rate. The results are discussed in terms of the deformational mechanisms which lead to the observed behavior.

MP 1859
IN-ICE CALIBRATION TESTS FOR AN ELONGATED, UNIAXIAL BRASS ICE STRESS SENSOR.

Johnson, J.B., International Offshore Mechanics and Arctic Engineering Symposium, 4th, Dallas, Texas, Feb. 17-21, 1985. Proceedings, Vol.2, New York, American Society of Mechanical Engineers, 1985, p.244-249, 8 refs.
39-2420
ICE LOADS, STRESSES, MEASURING INSTRUMENTS, LOADS (FORCES), DESIGN, TESTS.

An elongated, uniaxial brass ice stress sensor has been developed by the University of Alaska and used in several field experiments. Laboratory calibration tests have been conducted, in a 60 x 29.5 x 8.5 in. (1524 x 750 x 216 mm) ice block into which the sensor was frozen, to determine the sensor's response characteristics. Test results indicate that the sensor acts as a stress concentrator with a stress concentration factor of 2.4 and transverse sensitivity of -1.3 at stresses below 30 lbf/sq in (207 kPa). At stresses greater than 30 lbf/sq in the stress concentration factor increased and the sensor exhibited a time delay response to load. Differences of 22% were measured between the measured sensor stress immediately after a constant ice load was applied and the asymptotic stress limit. Interpretation of measured sensor stresses can be considered reliable at ambient ice stress levels below 30 lbf/sq in.

MP 1860
CALIBRATING CYLINDRICAL HOT-FILM ANEMOMETER SENSORS.

Andreas, E.L., et al, *Journal of atmospheric and oceanic technology,* June 1986, 3(2), p.283-298, Refs. p.298.
Murphy, B.
40-4484
ANEMOMETERS.

We report the results of 82 separate calibrations of cylindrical, platinum hot-film anemometer sensors in air. The calibrations for each sensor involved a determination of its temperature-resistance characteristics, a study of its heat transfer in forced convection, and an investigation of its yaw response. The convective heat transfer relation that we derive predicts the Nusselt number of the sensor as a linear function of R exp. 0.40, where R is the Reynolds number based on sensor diameter ($1<R<43$). For the 53 micrometer diameter sensors that we used, this heat transfer relation applies to wind speeds typical of the atmospheric surface layer, 1 to 20 m/s. From the heat transfer relation we also devise a method for determining hot-film operating characteristics at temperatures other than the calibration temperature. Hinze's relation is the best model for the yaw response of these sensors, being valid over virtually the entire range of yaw angles, 0 to 90 deg. Although the yaw parameter k does depend on the flow velocity, that dependence is so weak in the atmospheric surface layer that k can be assumed constant at 0.3.

MP 1861
TECHNIQUE FOR OBSERVING FREEZING FRONTS.

Colbeck, S.C., *Soil science,* Jan. 1985, 139(1), p.13-20, 8 refs.
39-2563
ICE WATER INTERFACE, FREEZING, ICE FORMATION, SOIL FREEZING, ICE LENSES, TESTS.

On the basis of observations of freezing fronts and liquid inclusions in liquid-saturated glass beads, a simple technique is described for making these direct observations. The ice-water interface at the freezing front was concave when viewed from the ice side, because the glass beads were preferentially wetted by the liquid. The size and number of liquid inclusions decreased with distance behind the freezing front. More liquid is trapped by smaller glass beads. The liquid inclusions are probably enriched in soluble impurities. No tendency for pressure buildup or ice lense formation was observed, perhaps because large particles were used. It is very important to extend these observations to other conditions, especially to smaller particle sizes.

MP 1862
GRAIN GROWTH AND THE CREEP BEHAVIOR OF ICE.

Cole, D.M., *Cold regions science and technology,* Feb. 1985, 10(2), p.187-189, 4 refs.
39-2560
ICE CREEP, ICE CRACKS, ICE FORMATION, GRAIN SIZE, RHEOLOGY, ICE GROWTH, STRAINS, TESTS.

MP 1863
THERMAL (2-5.6 MICRON) EMITTANCE OF DIATHERMANOUS MATERIALS AS A FUNCTION OF OPTICAL DEPTH, CRITICAL ANGLE AND TEMPERATURE.

Munis, R.H., et al, Society of Photo-Optical Instrumentation Engineers. Proceedings, Vol.510. Infrared technology X, Bellingham, WA, 1984, p.209-220, 11 refs.
Marshall, S.J.
39-2842
TEMPERATURE MEASUREMENT, MATERIALS, INFRARED PHOTOGRAPHY, THERMAL RADIATION, OPTICAL PROPERTIES, SPECTRA, REFLECTIVITY, TEMPERATURE EFFECTS, MATHEMATICAL MODELS.

Thermal measurements of the normal emittance of several diathermanous materials were made at 15.2 C, 4.9 C and -5.6 C. Calculations of the total hemispherical emittance were made from normal emittance and plotted against the optical depth. A comparison of these data with a model proposed by Gardon indicates that at near-ambient temperatures they agree very closely. It has been observed that normal emittance is greater than hemispherical emittance by approx. 5% for both weakly and strongly absorbing materials. This is attributable to phase differences in the multiply reflected internal radiation attempting to exit the specimen throughout steradians. Other radiation properties of the materials, i.e. diffuse transmittance, absorption coefficient, and absorption index were calculated.

MP 1864
ATTENUATION AND BACKSCATTER FOR SNOW AND SLEET AT 96, 140, AND 225 GHZ.

Nemarich, J., et al, *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* Dec. 1984, SR 84-35, Snow Symposium, 4th, Hanover, NH, Aug. 14-16, 1984. Proceedings, Vol.1, p.41-52, ADB-090 935, 3 refs.
Wellman, R.J., Gordon, B.E., Hutchins, D.R., Turner, G.A., Lacombe, J.
39-2947
ATTENUATION, SNOWFLAKES, BACKSCATTERING, ICE CRYSTALS, WAVE PROPAGATION, SNOWFALL, RAIN, TRANSMISSION, METEOROLOGICAL FACTORS.

Measurements are reported for attenuation and backscatter at 96, 140, and 225 GHz for falling snow and for mixed snow, sleet, and rain. The measurements were made with the Harry Diamond Laboratories Near-Millimeter Wave Mobile Measurement Facility at the SNOW-TWO Test at Grayling, MI, during the winter of 1983-1984. The dependence of the attenuation and backscatter levels on frequency, snow mass concentration, and ground-level air temperature are discussed. Measurements dade at 96 GHz with various combinations of transmitter and receiver polarizations showed no polarization-related effects on the attenuation or backscatter levels.

MP 1865
CATALOG OF SMOKE/OBSCURANT CHARACTERIZATION INSTRUMENTS.

O'Brien, H.W., et al, *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* Dec. 1984, SR 84-35, Snow Symposium, 4th, Hanover, NH, Aug. 14-16, 1984. Proceedings, Vol.1, p.77-82, ADB-090 935.
Bowen, S.L.
39-2950
WAVE PROPAGATION, TRANSMISSION, AIR POLLUTION, ELECTRICAL MEASUREMENT, ATTENUATION, OPTICAL PROPERTIES, SNOWFLAKES, AEROSOLS, DUST, MEASURING INSTRUMENTS, RADIOMETRY, BACKSCATTERING.

The requirement for improved quantification of obscuration parameters is generally recognized by those who attempt to measure, evaluate or predict electro-optical system performance during periods of adverse transmission conditions. A broad spectrum of measurement devices, ranging from simple to extremely sophisticated, are presently in use for making obscurant measurements. To minimize duplication of effort and to help disseminate information on the current status of instrumentation, the Project Manager for Smoke/Obscurants tasked the U.S. Army Cold Regions Research and Engineering Laboratory with initiating a catalog of instrumentation currently used by government agencies and their contractors to make obscuration measurements.

MP 1866
PERFORMANCE OF MICROPROCESSOR-CONTROLLED SNOW CRYSTAL REPLICATOR.

Koh, G., *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* Dec. 1984, SR 84-35, Snow Symposium, 4th, Hanover, NH, Aug. 14-16, 1984. Proceedings, Vol.1, p.107-111, ADB-090 935, 4 refs.
39-2954
SNOW CRYSTAL STRUCTURE, SNOWFALL, TRANSMISSION, ELECTROMAGNETIC PROPERTIES, SNOWFLAKES, ICE CRYSTAL REPLICAS, ARTIFICIAL SNOW.

Changes in snow crystal characteristics during snowstorms are frequently observed. A continuous record of these changes is required to study the effect of airborne snow on the transmission properties of electromagnetic energy. A continuous snow crystal replicator suitable for this task has been developed and was field- tested at the SNOW II exercise. This replicator, which employs a Formvar technique for snow crystal replication developed by Schaefer (1956) possesses electronic and mechanical features previously unavailable in other replicators and represents a significant improvement in Formvar replication technique. A microprocessor controls the operation of the replicator, resulting in improved quality of snow crystal replicas as well as a decrease in data reduction time. This is accomplished by 1) regulating the temperature of a heater bar designed to reduce blushing (condensed moisture on the film which obscures the detailed structures of replicated crystals), 2) ensuring uniform thickness of the Formvar coating by adjusting the flow rate according to film speed, 3) encoding time on the film, and 4) monitoring motion of the film to ensure proper operation of the replicator. A description of this instrument is presented and details of its operation at SNOW II are discussed.

MP 1867
NEW METHOD FOR MEASURING THE SNOW-SURFACE TEMPERATURE.

Andreas, E.L., *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* Dec. 1984, SR 84-35, Snow Symposium, 4th, Hanover, NH, Aug. 14-16, 1984. Proceedings, Vol.1, p.161-169, ADB-090 935, 5 refs.
39-2959
SNOW SURFACE TEMPERATURE, HUMIDITY, HYGROMETERS, DEW POINT, SURFACE ROUGHNESS, METEOROLOGICAL DATA, THERMISTORS, ANALYSIS (MATHEMATICS).

Because of the tenuousness of a snow cover, measuring its surface temperature is not easy. The surface is ill-defined and easily disturbed; invasive transducers commonly used for other surfaces may thus be inappropriate for snow. A hygrometric method is described for measuring the snow-surface temperature; the advantages are that it is non-invasive and non-radiative and that it depends only weakly on the surface structure. The key assumption is that air at a snow surface is in saturation with the snow; the dew-point temperature of the air is thus T(s), the surface temperature. Consequently, under the right conditions, by measuring the dew-point temperature 10 cm above the surface, we, in effect, measure the surface temperature.

MP 1868
OVERVIEW OF METEOROLOGICAL AND SNOW COVER CHARACTERIZATION AT SNOW-TWO.

Bates, R.E., et al, *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* Dec. 1984, SR 84-35, Snow Symposium, 4th, Hanover, NH, Aug. 14-16, 1984. Proceedings, Vol.1, p.171-191, ADB-090 935, 6 refs.
O'Brien, H.W.
39-2960
SNOW COVER DISTRIBUTION, SNOW PHYSICS, METEOROLOGICAL DATA, MILITARY OPERATION, SNOW DEPTH, SNOW DENSITY, UNFROZEN WATER CONTENT, TEMPERATURE DISTRIBUTION, GRAIN SIZE, TESTS.

The performance of military airborne down-look systems, regardless of wavelength, depends upon the recognition of differences between target and background features as viewed through an intervening medium. In cold regions the background may consist partially or entirely of snow cover during winter months. Prediction or evaluation of system performance under such conditions requires detailed characterization of snow cover, meteorological situation and, in some cases, subsurface features such as soil. This paper presents a brief overview of meteorological and snow cover background measurements made at Camp Grayling, Michigan, during SNOW-TWO. Eight independent system tests were supported, each of which required meteorological and/or snow-cover "ground-truth" characterization. Support was provided at four meteorological sites and seven snow cover characterization locations. Methodology is described briefly and a listing given of available data taken by CRREL in support of these tests.

MP 1869
APPROACH TO SNOW PROPAGATION MODELING.

Koh, G., *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* Dec. 1984, SR 84-35, Snow Symposium, 4th, Hanover, NH, Aug. 14-16, 1984. Proceedings, Vol.1, p.247-259, ADB-090 935, 9 refs.
39-2965
SNOWFALL, TRANSMISSIVITY, ATTENUATION, SNOW CRYSTAL STRUCTURE, SOLAR RADIATION, PARTICLE SIZE DISTRIBUTION, ELECTROMAGNETIC PROPERTIES, MATHEMATICAL MODELS, FALLING BODIES, INFRARED RADIATION, RADIATION ABSORPTION.

The attenuation of electromagnetic energy transmitted through falling snow can be determined if sufficient information regarding the physical and optical properties of airborne snow is known. Due to the complex and dynamic nature of falling snow the necessary parameters to predict transmission are often difficult to measure. Therefore it is necessary to carefully evaluate all the snow properties that are measurable in order to identify some ideal set of snow parameters that can be used to adequately model transmission through falling snow. A basic quantitative measurement of falling snow that can be continuously monitored is the mass concentration. Thus an approach to modeling transmittance through airborne snow using mass concentration as one of the inputs should be thoroughly investigated. This paper explores a potential method of predicting transmittance based on mass concentration measurement, taking into consideration the size and shape of the snow crystals. Although the paper focuses on visible radiation the concepts discussed are also applicable to infrared radiation.

MP 1870
FORWARD-SCATTERING CORRECTED EXTINCTION BY NONSPHERICAL PARTICLES.

Bohren, C.F., et al, *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* Dec. 1984, SR 84-35, Snow Symposium, 4th, Hanover, NH, Aug. 14-16, 1984. Proceedings, Vol.1, p.261-271, ADB-090 935, 16 refs.
Koh, G.
39-2966
SNOW CRYSTAL STRUCTURE, LIGHT SCATTERING, SNOWFLAKES, WAVE PROPAGATION, PARTICLES, ANALYSIS (MATHEMATICS).

Measured extinction of light by particles, especially those much larger than the wavelength of the light illuminating them, must be corrected for forward scattered light collected by the detector. Near-forward scattering by arbitrary nonspherical particles is, according to Fraunhofer diffraction theory, more sharply peaked than that by spheres of equal projected area. The difference between scattering by a nonspherical particle and that by an equal-area sphere is greater the more diffusely the particle's projected area is distributed about its centroid. Snowflakes are an example of large atmospheric particles that are often highly nonspherical. Calculations of the forward-scattering correction to extinction by ice needles have been made under the assumption that they can be approximated as randomly oriented prolate spheroids (aspect ratio 10:1). The correction factor can be as much as 20% less than that for equal-area spheres depending on the detector's acceptance angle and the wavelength. Randomly oriented oblate spheroids scatter more nearly like equal-area spheres.

MP 1871
DISCRETE REFLECTIONS FROM THIN LAYERS OF SNOW AND ICE.

Jezek, K.C., et al, *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* Dec. 1984, SR 84-35, Snow Symposium, 4th, Hanover, NH, Aug. 14-16, 1984. Proceedings, Vol.1, p.323-331, ADB-090 935, 11 refs.
Clay, C.S.
39-2971
REMOTE SENSING, SNOW PHYSICS, ICE PHYSICS, REFLECTION, RADAR ECHOES, WAVE PROPAGATION, SNOW ACOUSTICS, ICE ACOUSTICS, ELECTROMAGNETIC PROPERTIES.

A new approach was developed for computing the impulse response of a layered material. Our approach is different from other formulations in that we rely on a simple algorithm for polynomial division rather than the usual and more cumbersome matrix schemes. Our model is strictly valid for normally incident plane waves and does not allow for dispersion in a lossy material but we can account for geometrical spreading and believe the technique can be adapted for oblique incidence. The advantages of our technique are simplicity and the impulse nature of the solution. Consequently, we can compute the band limited response of the layered material through a straightforward convolution of the impulse response with any desired source function. In this paper, we outline the method and discuss examples of radar waves reflected from layers of snow and ice. We suggest the method may be a convenient tool for modelers studying acoustic and electromagnetic reflections from snow and ice cover.

MP 1872
EXPLOSIVE OBSCURATION SUB-TEST RESULTS AT THE SNOW-TWO FIELD EXPERIMENT.

Ebersole, J.F., et al, *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* Dec. 1984, SR 84-35, Snow Symposium, 4th, Hanover, NH, Aug. 14-16, 1984. Proceedings, Vol.1, p.347-354, ADB-090 935.
Williams, R.R., Bates, R.E.
39-2973
TRANSMISSIVITY, EXPLOSIVES, SNOW COVER, ICE COVER, VISIBILITY, ATTENUATION, TIME FACTOR, EXPLOSION EFFECTS, SANDS, TESTS.

A series of explosive obscuration trials was conducted in January 1984 as a sub-test to the SNOW-TWO field experiment conducted in Grayling, MI. In this paper, a discussion is presented of the time/space-dependent obscuration effects produced by explosives detonated on snow/ice ground cover. In addition, time/space-dependent thermal signatures of the resulting craters are presented.

MP 1873
SNOW CHEMISTRY OF OBSCURANTS RELEASED DURING SNOW-TWO/SMOKE WEEK VI.

Cragin, J.H., *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* Dec. 1984, SR 84-35, Snow Symposium, 4th, Hanover, NH, Aug. 14-16, 1984. Proceedings, Vol.1, p.409-416, ADB-090 935.
39-2980
SMOKE GENERATORS, SNOW COMPOSITION, CHEMICAL ANALYSIS, SNOWFALL, INFRARED RADIATION, VISIBILITY, PARTICLE SIZE DISTRIBUTION, AEROSOLS.

MP 1874
SNOW AND ICE PREVENTION IN THE UNITED STATES.

Minsk, L.D., *Neve international,* 1986, 28(1), p.37-42, In Italian with French, German and English summaries.
40-4443
SNOW REMOVAL, ICE REMOVAL, ICE CONTROL, ROAD MAINTENANCE, WINTER MAINTENANCE, COUNTERMEASURES, SNOW ACCUMULATION, CHEMICAL ICE PREVENTION, UNITED STATES.

MP 1875
ANALYSIS OF RIVER WAVE TYPES.

Ferrick, M.G., *Water resources research,* Feb. 1985, 21(2), p.209-220, 20 refs.
39-3098
WAVE PROPAGATION, RIVER FLOW, ICE JAMS, DAMS, ELECTRIC POWER, FLOODS, RAIN, MATHEMATICAL MODELS.

In this paper we consider long-period, shallow-water waves in rivers that are a consequence of unsteady flow. River waves result from hydroelectric power generation or flow control at a dam, the breach of a dam, the formation or release of an ice jam, and rainfall-runoff processes. The Saint-Venant equations are generally used to describe river waves. This paper is an investigation into areas which are fundamental to river wave modeling. The analysis is based on the concept that river wave behavior is determined by the balance between friction and inertia. The Saint-Venant equations are combined to form a system equation that is written in dimensionless form. The dominant terms of the system equation change with the relative magnitudes of a group of dimensionless scaling parameters that quantify the friction-inertia balance. These scaling parameters are continuous, indicating that the various river wave types and the transitions between them form a spectrum.

MP 1876
EFFECT OF ICE COVER ON HYDROPOWER PRODUCTION.

Yapa, P.D., et al, *Journal of energy engineering,* Sep. 1984, 110(3), p.231-234, 7 refs.
Shen, H.T.
39-3096
ICE COVER EFFECT, RIVER FLOW, RIVER ICE, WATER LEVEL, DAMS, ICE CONDITIONS, ELECTRIC POWER, ICE SURFACE, ICE COVER STRENGTH, SURFACE ROUGHNESS.

MP 1877

EFFECT OF SAMPLE ORIENTATION ON THE COMPRESSIVE STRENGTH OF MULTI-YEAR PRESSURE RIDGE ICE SAMPLES.

Richter-Menge, J.A., et al, Conference Arctic '85. Proceedings. Civil engineering in the Arctic offshore. Edited by F.L. Bennett and J.L. Machemehl, New York, American Society of Civil Engineers, 1985, p.465-475, 13 refs.
Cox, G.F.N.
39-3196
PRESSURE RIDGES, COMPRESSIVE PROPERTIES, ICE STRENGTH, IMPACT STRENGTH, STRAINS, POROSITY, ICE SAMPLING, BEAUFORT SEA.

Matched pairs of horizontal and vertical sea ice samples were taken from a multi-year pressure ridge in the Beaufort Sea. Each pair was tested in uniaxial constant strain-rate compression to evaluate the effect of sample orientation on the compressive strength. The results indicate that sample orientation must be considered in the interpretation of ridge compressive strength data.

MP 1878

TRIAXIAL COMPRESSION TESTING OF ICE.

Cox, G.F.N., et al, Conference Arctic '85. Proceedings. Civil engineering in the Arctic offshore. Edited by F.L. Bennett and J.L. Machemehl, New York, American Society of Civil Engineers, 1985, p.476-488, 11 refs.
Richter-Menge, J.A.
39-3197
ICE STRENGTH, COMPRESSIVE PROPERTIES, STRESS, STRAIN DIAGRAMS, TESTS, MEASURING INSTRUMENTS.

Procedures have been refined for performing constant-strain-rate triaxial tests on ice samples. The equipment is designed such that the confining pressure/axial stress ratio remains constant. Sample axial displacements are measured inside the cell on the sample and outside the cell between the cell and the loading piston. In addition to reviewing the development of the equipment and testing procedures, data are presented to illustrate the problems of using outside displacement measurements. In general, direct axial displacement measurements on the sample are essential to obtain accurate test strain rates and ice moduli. This is particularly true for brittle ice at low temperatures, high strain rates, and high confining pressures.

MP 1879

SHEAR STRENGTH IN THE ZONE OF FREEZING IN SALINE SOILS.

Chamberlain, E.J., Conference Arctic '85. Proceedings. Civil engineering in the Arctic offshore. Edited by F.L. Bennett and J.L. Machemehl, New York, American Society of Civil Engineers, 1985, p.566-574, 4 refs.
39-3205
FROZEN GROUND STRENGTH, SALINE SOILS, SHEAR STRENGTH, DEFORMATION, SOIL FREEZING, CLAY SOILS, SANDS, SEA WATER, TEMPERATURE EFFECTS, TESTS.

Laboratory direct shear strength tests were conducted on sand and clay soil samples as they were freezing. Samples prepared with seawater and distilled water were tested in a modified direct shear box at shear plane temperatures ranging from 0 C to -5 C. The shear strengths of the freezing saline clay and sand samples were observed to be significantly less than shear strengths of the fresh water samples. For the clay samples, these shear strength differences could be accounted for principally by the 1.8 C freezing point depression caused by the salts in the sea water, the two shear strength curves nearly paralleling and overlapping each other when plotted versus temperature below freezing. In a similar plot for the sands, the two curves diverge considerably from a common strength at 0 C. It is shown that the shear strength reduction of the saline clay soil is principally the result of increased unfrozen water content. It is postulated that knowledge of unfrozen water content relationships for frozen saline soils will probably allow better predictive capabilities for the shear strength in the freezing zone.

MP 1880

EXPLORATION OF A RIGID ICE MODEL OF FROST HEAVE.

O'Neill, K., et al, *Water resources research,* Mar. 1985, 21(3), p.281-296, 29 refs.
Miller, R.D.
39-3276
FROST HEAVE, GROUND ICE, ICE MODELS, ICE LENSES, FREEZING RATE, ICE GROWTH, MATHEMATICAL MODELS, FROZEN GROUND THERMODYNAMICS.

A numerical model is explored which simulates frost heave in saturated, granular, air-free, solute-free soil. It is based on equations developed from fundamental thermomechanical considerations and previous laboratory investigations. Although adequate data are lacking for strict experimental verification of the model, we note that simulations produce an overall course of events together with significant specific features which are familiar from laboratory experience. Simulated heave histories show proper sensitivities in the shapes and orders of magnitude of output responses and in the relations between crucial factors such as heave rate, freezing rate, and overburden.

MP 1881

SIMILARITY SOLUTIONS OF THE CAUCHY PROBLEM OF HORIZONTAL FLOW OF WATER THROUGH POROUS MEDIA FOR EXPERIMENTAL DETERMINATION OF DIFFUSIVITY.

Nakano, Y., *Advances in water resources,* Mar. 1985, 8(1), p.26-31, 23 refs.
39-3379
POROUS MATERIALS, WATER FLOW, DIFFUSION, WATER CONTENT, MATHEMATICAL MODELS, EXPERIMENTATION.

An experimental method for determining diffusivity is studied by using similarity solutions of the Cauchy problem of horizontal flow of water through homogeneous porous media. The theoretical justification of the method is presented by applying a mathematical theorem recently derived by Van Duyn. Some important aspects of data analysis are discussed by using actual experimental data.

MP 1882

NUMERICAL SIMULATION OF NORTHERN HEMISPHERE SEA ICE VARIABILITY, 1951-1980.

Walsh, J.E., et al, *Journal of geophysical research,* May 20, 1985, 90(C3), p.4847-4865, 36 refs.
Hibler, W.D., III, Ross, B.
39-3431
SEA ICE, ENVIRONMENT SIMULATION, SEASONAL VARIATIONS, ICE MODELS, DRIFT, ICE COVER THICKNESS.

The model is run with a daily time step and is forced by interannually varying fields of geostrophic wind and termperature-derived thermodynamic fluxes. The results include documentation of the sensitivities to the source of the thermodynamic forcing data and to the number of thickness levels in the thermodynamic formulation. The fields of ice velocity and thickness show strong seasonal as well as interannual variability. The Pacific gyre is found to be well-developed in spring and autumn but less so in winter and summer. The simulated velocities show no bias but considerable scatter relative to the drift of the Arctic buoys in 1979 and 1980. An analysis of the regional mass budgets shows that the normal seasonal cycle is controlled primarily by the thermodynamic processes but that the thickness anomalies in much of the Arctic are attributable primarily to dynamic processes during winter, spring, and autumn. Thermodynamic processes contribute more strongly to summer anomalies near the ice edge. The tendency for ice anomalies to be advected by the pattern of mean drift is apparent in multiseason lag correlations involving subregions of the Arctic Basin and the peripheral seas. (Auth. mod.)

MP 1883

GROWTH AND MECHANICAL PROPERTIES OF RIVER AND LAKE ICE.

Ramseier, R.O., Quebec, P.Q., Université Laval, Feb. 1972, 243p., Ph.D. thesis. Corrected Oct. 1975. 119 refs.
39-3387
ICE MECHANICS, RIVER ICE, LAKE ICE, ICE GROWTH, ICE CRYSTAL STRUCTURE, ICE PHYSICS, SNOW ICE, TEMPERATURE EFFECTS, METEOROLOGICAL FACTORS, GRAIN SIZE, ICE CREEP, EXPERIMENTATION.

MP 1884

SCIENCE PROGRAM FOR AN IMAGING RADAR RECEIVING STATION IN ALASKA.

Weller, G., et al, *Pasadena, CA,* U.S. National Aeronautics and Space Administration, Dec. 1, 1983, 45p., 19 refs.
Carsey, F., Holt, B., Rothrock, D.A., Weeks, W.F.
39-3415
REMOTE SENSING, ICE CONDITIONS, STATIONS, RESEARCH PROJECTS, SEA ICE DISTRIBUTION, OCEANOGRAPHY, MARINE GEOLOGY, GLACIOLOGY, VEGETATION, UNITED STATES—ALASKA, ARCTIC OCEAN.

There would be broad scientific benefit in establishing in Alaska an imaging radar receiving station that would collect data from the European Space Agency's Remote Sensing Satellite, ERS-1; this station would acquire imagery of the ice cover from the American territorial waters of the Beaufort, Chukchi, and Bering Seas; this station, in conjunction with similar stations proposed for Kiruna, Sweden, and Prince Albert, Canada, would provide synoptic coverage of nearly the entire Arctic. The value of such coverage to aspects of oceanography, geology, glaciology, and botany is considered.

MP 1885

CONTROLLING RIVER ICE TO ALLEVIATE ICE JAM FLOODING.

Deck, D.S., IAHR International Symposium on Ice, 7th, Hamburg, F.R.G., Aug. 27-31, 1984. Proceedings, Vol.3, [1984], p.69-76, 4 refs.
39-3471
ICE CONTROL, RIVER ICE, ICE JAMS, FLOODS, ICE BOOMS, ICE BREAKUP, ICE COVER THICKNESS, MODELS, COUNTERMEASURES.

Many communities affected by ice jam flooding have accepted the event as unpreventable. Others have approached their problem as one of open channel flow and implemented standard projects such as channel modifications or dikes to combat their flooding. We feel that the best approach is to control the river ice before it poses a problem, by controlling either freeze-up or break-up. This paper addresses our involvement at two areas where ice jam flooding has caused severe economic hardship and loss of life. An ice boom has been used to control the formation of river ice at Oil City, Pennsylvania, and a permanent ice control structure will be constructed on Cazenovia Creek in West Seneca, New York, to control the river ice during break-up.

MP 1886

4TH REPORT OF WORKING GROUP ON TESTING METHODS IN ICE.

Earle, E.N., et al, IAHR International Symposium on Ice, 7th, Hamburg, F.R.G., Aug. 27-31, 1984. Proceedings, Vol.4, [1984], p.1-41, Refs. passim.
Frederking, R., Gavrilo, V.P., Goodman, D.J., Häusler, F.U., Mellor, M., Petrov, I.G., Vaudrey, K.
39-3494
ICE PHYSICS, ICE STRENGTH, AIR ENTRAINMENT, ICE FRICTION, COMPRESSIVE PROPERTIES, FLEXURAL STRENGTH.

MP 1887

FORCES ASSOCIATED WITH ICE PILE-UP AND RIDE-UP.

Sodhi, D.S., et al, IAHR International Symposium on Ice, 7th, Hamburg, F.R.G., Aug. 27-31, 1984. Proceedings, Vol.4, [1984], p.239-262, Refs. p.257-262.
Kovacs, A.
39-3500
ICE LOADS, ICE PILEUP, ICE OVERRIDE, FLOATING ICE, ICE MECHANICS, ICE PRESSURE, ICE SOLID INTERFACE, WIND FACTORS, OCEAN WAVES, ANALYSIS (MATHEMATICS), PRESSURE RIDGES.

A review of the literature on shore ice pile-up and ride-up observations is presented along with the average forces associated with the phenomena. Besides wind/water driving forces, it is postulated that storm surges or waves may also carry the floating ice sheet farther inland, where damage to structures and human lives is possible. A brief review is presented of the analytical and experimental work done to understand the behavior of ice sheets in relation to its piling or riding up the beach. A short summary of each model study that is reported in open literature is also given.

MP 1888

HEAT AND MOISTURE ADVECTION OVER ANTARCTIC SEA ICE.

Andreas, E.L., *Monthly weather review,* May 1985, 113(5), p.736-746, 27 refs.
39-3554
ICE EDGE, HEAT LOSS, SEA ICE DISTRIBUTION, PACK ICE, ANTARCTICA—WEDDELL SEA.

Surface-level meteorological observations and upper-air soundings in the Weddell Sea provide the first *in situ* look at conditions over the deep antarctic ice pack in the spring. The surface-level temperature and humidity were relatively high, and both were positively correlated with the northerly component of the 850 mb wind vector as far as 600 km from the ice edge. Since even at its maximum extent, at least 60% of the antarctic ice pack is within 600 km of the open ocean, long-range atmospheric transport of heat and moisture from the ocean must play a key part in antarctic sea ice heat and mass budgets. From one case study, the magnitude of the ocean's role is inferred: at this time of year the total turbulent surface heat loss can be greater under southerly winds than under northerly ones. (Auth.)

MP 1889

ENERGY EXCHANGE OVER ANTARCTIC SEA ICE IN THE SPRING.

Andreas, E.L., et al, *Journal of geophysical research,* July 20, 1985, 90(C4), p.7199-7212, Refs. p.7211-7212.
Makshtas, A.P.
39-3640
SEA ICE, ABLATION, RADIATION BALANCE, HEAT FLUX.

In October and November of 1981, during the U.S.-USSR Weddell Polynya Expedition, we made the first measurements ever of the turbulent and radiative fluxes over the interior pack ice of the southern ocean. The daily averaged, surface-averaged sum of these fluxes—the so-called balance, which comprises the conductive, heat storage, and phase-change terms—was positive for all but one day during the cruise: the ablation season had begun. Variability in the sum of the turbulent fluxes produced most of the variability in the balance. These turbulent fluxes generally correlated with the geostrophic wind—a northerly wind (in off the ocean) transferring heat to the surface, and a southerly wind removing it. (Auth.)

MP 1890

USE OF REMOTE SENSING FOR THE U.S. ARMY CORPS OF ENGINEERS DREDGING PROGRAM.

McKim, H.L., et al, International Symposium on *Remote Sensing of Environment*, 18th, Paris, France, Oct. 1-5, 1984. Proceedings, Ann Arbor, Environmental Research Institute of Michigan, ₍1985₎, p.1141-1150, Refs. p.1147-1149.

Klemas, V., Gatto, L.W., Merry, C.J.

39-3707

REMOTE SENSING, DREDGING, SEDIMENT TRANSPORT, CHANNELS (WATERWAYS), SUSPENDED SEDIMENTS, ENVIRONMENTAL IMPACT.

The objectives of this study were to review the uses of existing remote sensing techniques for providing data in the Corps of Engineers dredging program, to define promising new techniques for minotoring dredging operations, and to recommend those techniques that should be used now and those to be developed for future use. The uses for which remote sensing techniques were evaluated include: channel surveys and engineering considerations, monitoring of sediment drift and dispersion during dredging operations, monitoring of water quality and suspended sediment concentration, disposal site selection and minitoring of environmental effects at disposal sites, and long-range dredged material disposal management strategies.

MP 1891

FULL-CYCLE HEATING AND COOLING PROBE METHOD FOR MEASURING THERMAL CONDUCTIVITY.

McGaw, R., *Journal of heat transfer*, ₍1984₎, No.84-WA/HT-109, 8p., 32 refs.

39-3902

THERMAL CONDUCTIVITY, COOLING, HEATING, THERMAL DIFFUSION, ANALYSIS (MATHEMATICS), TESTS.

A modification of the traditional probe test procedure is described which incorporates the cooling stage that succeeds each heating stage. The improved procedure enables a second value of thermal conductivity to be determined for each test. A comparison between the two values gives a measure of the experimental error for the test, and provides a means by which physical changes within the test specimen may be detected. If the ambient test temperature of the specimen has altered during a test, the effect on the test values may also be determined through a comparison of the heating-stage and cooling-stage temperatures.

MP 1892

AUTOMATED SOILS FREEZING TEST.

Chamberlain, E.J., National Conference on Microcomputers in Civil Engineering, 2nd, Orlando, Florida, Oct. 30-Nov. 1, 1984. Proceedings. Edited by W.E. Carroll, ₍1985₎, 5p., 2 refs.

39-3903

SOIL FREEZING, FREEZE THAW CYCLES, FROST HEAVE, FREEZE THAW TESTS, THERMOCOUPLES, COMPUTER PROGRAMS.

An inexpensive data acquisition/control system is used to control the freeze-thaw cycling and data logging in a new laboratory freezing test. The test imposes two freeze-thaw cycles on four soil samples. The data logger is set up with 3-10 channel multiplexer cards for analog measurement and actuator control. Two of the multiplexer cards are configured for a total of 36 single-ended thermocouple measurements which are accurate to plus or minus 0.1 C. The third multiplexer card is configured with two actuator switches to control the temperatures of two refrigerated circulating baths and with five double-ended channels to read the output of four linear motion DC transformers and one power supply. The data acquisition/control unit is controlled using a HP41CX hand-held calculator and the HP-IL serial interface loop. A thermal printer, tape cassette deck and x-y plotter are used to print out, store and plot the test data. The calculator is programmed with over 30 programs and subroutines to control the temperature, and to reduce, print out, store and plot the test data.

MP 1893

2-D TRANSIENT FREEZING IN A PIPE WITH TURBULENT FLOW, USING A CONTINUALLY DEFORMING MESH WITH FINITE ELEMENTS.

Albert, M.R., et al, International Conference on Numerical Methods in Thermal Problems, 3rd, Seattle, WA, Aug. 2-5, 1983. Proceedings. Edited by R.W. Lewis, J.A. Johnson and W.R. Smith, Swansea, U.K., Pineridge Press, 1983, p.102-112, 10 refs.

O'Neill, K.

39-3963

PIPELINE FREEZING, TURBULENT FLOW, HEAT FLUX, HEAT TRANSFER, ANALYSIS (MATHEMATICS), FLOW RATE.

MP 1894

SOLUTION OF 2-D AXISYMMETRIC PHASE CHANGE PROBLEMS ON A FIXED MESH, WITH ZERO WIDTH PHASE CHANGE ZONE.

O'Neill, K., International Conference on Numerical Methods in Thermal Problems, 3rd, Seattle, WA, Aug. 2-5, 1983. Proceedings. Edited by R.W. Lewis, J.A. Johnson and W.R. Smith, Swansea, U.K., Pineridge Press, 1983, p.134-146, 21 refs.

39-3965

THERMAL CONDUCTIVITY, ENTHALPY, ARTIFICIAL FREEZING, HEAT CAPACITY, PHASE TRANSFORMATIONS, SOIL FREEZING, BOUNDARY LAYER, ANALYSIS (MATHEMATICS).

A new method is presented for solving two-dimensional axisymmetric heat conduction problems with phase change. A strict discontinuity between phases is assumed, and no artificially smoothed enthalpy transition between phases need be introduced. Step changes across phase boundaries in the sensible heat capacity and thermal conductivity are accommodated, when the phase change isotherm cuts arbitrarily across a fixed mesh of linear triangular finite elements. Latent heat effects are accounted for through a Dirac delta function in the heat capacity. This is absorbed mathematically and its effects distributed appropriately over discrete mesh entities in the course of ordinary Galerkin finite element procedures. Computed results agree well with analytical solutions in the limited cases where they are available, and numerical results in more general cases behave quite reasonably.

MP 1895

COMPUTATION OF POROUS MEDIA NATURAL CONVECTION FLOW AND PHASE CHANGE.

O'Neill, K., et al, International Conference on Finite Elements in Water Resources, 5th, Burlington, VT, June 1984. Proceedings. Edited by J.P. Laible, C.A. Brebbia, W. Gray and G. Pinder, Berlin, Springer-Verlag, 1984, p.213-229, 13 refs.

Albert, M.R.

39-3981

POROUS MATERIALS, FLUID FLOW, PHASE TRANSFORMATIONS, CONVECTION, HEAT TRANSFER, HEAT CAPACITY, BOUNDARY LAYER, COMPUTER APPLICATIONS, ANALYSIS (MATHEMATICS).

MP 1896

ROLE OF PHASE EQUILIBRIUM IN FROST HEAVE OF FINE-GRAINED SOIL UNDER NEGLIGIBLE OVERBURDEN PRESSURE.

Nakano, Y., et al, *Advances in water resources*, June 1985, 8(2), p.50-68, 17 refs.

Horiguchi, K.

40-33

FROST HEAVE, UNFROZEN WATER CONTENT, SOIL WATER, SUPERCOOLING, PRESSURE, PHASE TRANSFORMATIONS, SOIL FREEZING, ANALYSIS (MATHEMATICS).

The role of the phase equilibrium of water in frost heave was studied for two kinds of soil. The rate of frost heave and the rate of water intake were measured simultaneously under various rates of heat removal. The experimental data revealed a trend common for both soils that the rate of water intake attains its maximum at a certain critical rate of heat removal. The data were analyzed by using equations accurately describing the relation between these rates. The results of the analysis indicate a serious doubt about the validity of phase equilibrium in the system. Alternatively, an assumption was introduced that supercooling occurred between a frost front and an unfrozen part of the soil. It was shown that supercooling could explain the data well under certain conditions.

MP 1897

EXPERIMENTAL STUDY ON FACTORS AFFECTING WATER MIGRATION IN FROZEN MORIN CLAY.

Xu, X., et al, Ground freezing. Proceedings of the 4th International Symposium on Ground Freezing, Sapporo, Japan, Aug. 5-7, 1985. Edited by S. Kinoshita and M. Fukuda. Rotterdam, A.A. Balkema, 1985, p.123-128.

Oliphant, J.L., Tice, A.R.

40-213

FROZEN GROUND PHYSICS, SOIL WATER MIGRATION, CLAY SOILS, FROST HEAVE, DENSITY (MASS/VOLUME), SATURATION, SOIL FREEZING, TEMPERATURE GRADIENTS, TESTS.

The amount of water migration in an unsaturated frozen soil, morin clay, was determined in horizontally closed soil columns under linear temperature gradients. The temperature at the warm end of the soil column was below its freezing point at the initial water content in order to keep the soil specimen always in the frozen state during testing. The flux of water migration was calculated from the distribution curves of the total water content before and after testing. Four factors affecting the flux, including temperature, temperature gradient, test duration and the dry density of the soil, were investigated. It was found that the flux is directly proportional to the temperature gradient, is inversely proportional to the square root of the test duration, decreases with the decrease in temperature in the power law form, and changes with the dry density. The behavior of water migration in unsaturated, frozen morin clay is something like that in the unsaturated, unfrozen soils.

MP 1898

STRAIN RATE EFFECT ON THE TENSILE STRENGTH OF FROZEN SILT.

Zhu, Y., et al, Ground freezing. Proceedings of the 4th International Symposium on Ground Freezing, Sapporo, Japan, Aug. 5-7, 1985. Edited by S. Kinoshita and M. Fukuda, Rotterdam, A.A. Balkema, 1985, p.153-157, 9 refs.

Carbee, D.L.

40-217

FROZEN GROUND STRENGTH, PERMAFROST PHYSICS, STRAINS, TENSILE PROPERTIES, TEMPERATURE EFFECTS, DENSITY (MASS/VOLUME), TESTS.

Tension tests at constant rates were conducted on remolded saturated frozen Fairbanks silt with medium density at -5 C for various machine speeds. It is found that the tensile strength depends strongly upon strain rate and the critical strain rate for ductile-brittle transition was about 1/100s. The peak tensile strength considerably decreases with decreasing strain rate for ductile failure, while it slightly decreases with increasing strain rate in the brittle region. The failure strain also varies with strain rate, but the initial tangent modulus is found not to be dependent upon strain rate.

MP 1899

KADLUK ICE STRESS MEASUREMENT PROGRAM.

Johnson, J.B., et al, International Conference on Port and Ocean Engineering under Arctic Conditions, 8th, Narssarssuaq, Greenland, Sep. 7-14, 1985. Proceedings, Vol.1, Hörsholm, Denmark, Danish Hydraulic Institute, 1985, p.88-100, 9 refs.

Cox, G.F.N., Tucker, W.B.

40-268

ICE SHEETS, STRESSES, ICE LOADS, OFFSHORE STRUCTURES, ICE CONDITIONS, ICE PRESSURE, THERMAL EXPANSION.

Cylindrical biaxial stress sensors were used to measure ice stress variations as a function of depth across an ice peninsula on the shoreward side (south) of Kadluk Island. The stresses varied in a complex manner both laterally and with depth in the ice sheet. Average stresses were calculated and summed across the ice peninsula to determine the ice load acting on the structure. The maximum measured average stress and corresponding calculated structural load during the experiment were about 300 kPa and 150 MN respectively. All significant measured stresses were caused by thermal expansion of the ice sheet.

MP 1900

ICE ISLAND FRAGMENT IN STEFANSSON SOUND, ALASKA.

Kovacs, A., International Conference on Port and Ocean Engineering under Arctic Conditions, 8th, Narssarssuaq, Greenland, Sep. 7-14, 1985. Proceedings, Vol.1, Hörsholm, Denmark, Danish Hydraulic Institute, 1985, p.101-115, 9 refs.

40-269

ICE ISLANDS, ICE STRENGTH, ICE PHYSICS, GROUNDED ICE, CALVING, ICE COVER THICKNESS, ICE SALINITY, ICE DENSITY, ICE TEMPERATURE, STATISTICAL ANALYSIS.

A small ice island fragment was found in a unique location southwest of Cross Island, Alaska, in April 1983. Investigations were made to determine the thickness, salinity, density, internal temperature, and strength of the ice island ice. Measurements were also made which revealed that the ice island was grounded. Side scan sonar, depth profiles and direct sounding measurements of the sea bottom revealed that the ice island had gouged into the seabed when it was driven into shallower waters. Implications of this ice feature to offshore petroleum development are discussed.

MP 1901

APPARENT UNCONFINED COMPRESSIVE STRENGTH OF MULTI-YEAR SEA ICE.

Kovacs, A., International Conference on Port and Ocean Engineering under Arctic Conditions, 8th, Narssarssuaq, Greenland, Sep. 7-14, 1985. Proceedings, Vol.1, Hörsholm, Denmark, Danish Hydraulic Institute, 1985, p.116-127, 4 refs.

40-270

ICE STRENGTH, SEA ICE, ICE LOADS, COMPRESSIVE PROPERTIES, ICE TEMPERATURE, ICE DENSITY, BRINES, TESTS.

An axial double-ball load test system for determining the apparent unconfined compressive strength of multi-year sea ice was evaluated. The effects of loading ball size, ice temperature, and brine free density on the apparent unconfined compressive strength of the ice were investigated. Axial double-ball load test results are compared with those obtained from labor intensive conventional unconfined compression tests made on similar density ice. The results from the two testing methods were found to agree very well, indicating that the axial double-ball load test may be used to provide a rapid method for determining an apparent unconfined compressive strength index for ice.

MP 1902

INVESTIGATION OF THE ELECTROMAGNETIC PROPERTIES OF MULTI-YEAR SEA ICE.

Morey, R.M., et al, International Conference on Port and Ocean Engineering under Arctic Conditions, 8th, Narssarssuaq, Greenland, Sep. 7-14, 1985. Proceedings, Vol.1, Hörsholm, Denmark, Danish Hydraulic Institute, 1985, p.151-167, 11 refs.
Kovacs, A.
40-273
ICE ELECTRICAL PROPERTIES, ELECTROMAGNETIC PROPERTIES, SEA ICE, ICE COVER THICKNESS, ICE BOTTOM SURFACE, REMOTE SENSING, PROFILES, ICE DETECTION, ICE STRUCTURE, ICE MODELS, BRINES, RADAR ECHOES.

Sounding of multi-year sea ice, using impulse radar operating in the 80- to 500-MHz frequency band, revealed that the bottom of this ice could not always be detected. This paper discusses the results of a field program aimed at finding out why the bottom of thick multi-year sea ice could not be profiled and at determining the electromagnetic (EM) properties of multi-year sea ice. It was found that the bottom of the ice could not be detected when the ice structure had a high brine content. Because of brine's high conductivity, its volume dominates the loss mechanism in first-year sea ice, and the same was found true for multi-year sea ice. A two-phase dielectric mixing formula, used by the authors for describing the EM properties of first-year sea ice, was modified to include the effects of the gas pockets found in the multi-year sea ice. This three-phase mixture model was found to estimate the EM properties of the multi-year ice studied over the frequency band of interest. The latter values were determined by 1) vertical sounding to a subsurface target of known depth and 2) cross-borehole transmission measurements.

MP 1903

PHYSICAL PROPERTIES OF SEA ICE IN THE GREENLAND SEA.

Tucker, W.B., et al, International Conference on Port and Ocean Engineering under Arctic Conditions, 8th, Narssarssuaq, Greenland, Sep. 7-14, 1985. Proceedings, Vol.1, Hörsholm, Denmark, Danish Hydraulic Institute, 1985, p.177-188, 9 refs.
Gow, A.J., Weeks, W.F.
40-275
ICE PHYSICS, SEA ICE, PACK ICE, ICE SALINITY, ICE TEMPERATURE, ICE COVER THICKNESS, ICE CRYSTAL STRUCTURE, SNOW DEPTH, GREENLAND SEA.

The physical properties of sea ice in the Fram Strait region of the Greenland Sea were examined during June and July 1984 in conjunction with the MIZEX field program. The properties of the pack ice in the Fram Strait are believed to be representative of ice from many locations within the Arctic Basin since Fram Strait is the major ice outflow region for the Basin. Most of the ice observed and sampled was multi-year. The majority of the first-year ice appeared to have been deformed prior to entering Fram Strait. The properties measured at each sampling site included salinity, temperature, thickness, crystal structure and snow depth. The measured salinities agreed well with those taken during summer at other locations in the Arctic. An important finding was that snow depths on multi-year ice were much larger than those on first-year ice. Finally, the crystal texture analysis indicated that about 75% of the ice consisted of congelation ice with typically columnar type crystal structure. The remaining 25% consisted of granular ice.

MP 1904

NUMERICAL SIMULATION OF ICE GOUGE FORMATION AND INFILLING ON THE SHELF OF THE BEAUFORT SEA.

Weeks, W.F., et al, International Conference on Port and Ocean Engineering under Arctic Conditions, 8th, Narssarssuaq, Greenland, Sep. 7-14, 1985. Proceedings, Vol.1, Hörsholm, Denmark, Danish Hydraulic Institute, 1985, p.393-407, 12 refs.
Tucker, W.B., Niedoroda, A.W.
40-294
ICE SCORING, BOTTOM TOPOGRAPHY, BOTTOM SEDIMENT, OCEAN BOTTOM, SEDIMENT TRANSPORT, MODELS, DISTRIBUTION, COMPUTER APPLICATIONS, BEAUFORT SEA.

A simulation model for sea ice-induced gouges on the shelf of the Beaufort Sea is developed by assuming that annual occurrence of new gouges is given by a Poisson distribution, locations of the gouges are random, and distribution of gouge depths is specified by an exponential distribution. Once a gouge is formed it is subject to infilling by transport of sediment into the region and by local movement of sediment along the sea floor. These processes are modeled by assuming a sediment input based on stratigraphic considerations and by calculating bedload transport using methods from sediment transport theory. It is found that if currents are sufficient to transport sediment, rapid infilling of gouges occurs.

MP 1905

REVIEW OF EXPERIMENTAL STUDIES OF UPLIFTING FORCES EXERTED BY ADFROZEN ICE ON MARINA PILES.

Christensen, F.T., et al, International Conference on Port and Ocean Engineering under Arctic Conditions, 8th, Narssarssuaq, Greenland, Sep. 7-14, 1985. Proceedings, Vol.2, Hörsholm, Denmark, Danish Hydraulic Institute, 1985, p.529-542, 30 refs.
Zabilansky, L.J.
40-303
PILE EXTRACTION, ICE ADHESION, WATER LEVEL, SHEAR PROPERTIES, FLEXURAL STRENGTH, ICE COVER EFFECT, ICE SOLID INTERFACE, ICE LOADS, ICE PHYSICS, CONSTRUCTION MATERIALS.

Over the last decade the problem of pile jacking has been studied experimentally, both in the field and in laboratory studies. This paper reviews the findings of these studies and suggests subjects for further research.

MP 1906

SHEET ICE FORCES ON A CONICAL STRUCTURE: AN EXPERIMENTAL STUDY.

Sodhi, D.S., et al, International Conference on Port and Ocean Engineering under Arctic Conditions, 8th, Narssarssuaq, Greenland, Sep. 7-14, 1985. Proceedings, Vol.2, Hörsholm, Denmark, Danish Hydraulic Institute, 1985, p.643-655, 11 refs.
Morris, C.E., Cox, G.F.N.
40-312
ICE PRESSURE, ICE SHEETS, OFFSHORE STRUCTURES, ICE LOADS, FLEXURAL STRENGTH, SURFACE PROPERTIES, ICE LOADS, FRICTION, EXPERIMENTATION.

Small-scale experiments were performed to determine sheet ice forces on a conical structure. The experiments were conducted with a 45 deg upward-breaking conical structure which had diameters of 1.5 m at the waterline and 0.33 m at the top. The surface of the structure was initially smooth; later it was roughened to investigate the effect of surface friction on the ice load. The thickness and the flexural strength of ice sheets were varied, and the tests were conducted at three fixed velocities.

MP 1907

GRAIN SIZE AND THE COMPRESSIVE STRENGTH OF ICE.

Cole, D.M., *Journal of energy resources technology*, Sep. 1985, 107(3), p.369-374, 15 refs.
40-363
ICE STRENGTH, ICE MECHANICS, COMPRESSIVE PROPERTIES, GRAIN SIZE, LOADS (FORCES), ICE CRYSTAL STRUCTURE, STRESS STRAIN DIAGRAMS, ICE CRACKS, TEMPERATURE EFFECTS, FRACTURING.

This work presents the results of uniaxial compression tests on freshwater polycrystalline ice. Grain size of the test material ranged from 1.5 to 5 mm, strain rate ranged from 1/1,000,000 to 1/100/s and the temperature was -5 C. The grain size effect emerged clearly as the strain rate increased to 1/100,000/s and persisted to the highest applied strain rates. On average, the stated increase in grain size brought about a decrease in peak stress of approximately 31 percent. The occurrence of the grain size effect coincided with the onset of visible cracking. The strength of the material increased to a maximum at a strain rate of 1/1,000/s, and then dropped somewhat as the strain rate increased further to 1/100/s. Strain at peak stress generally tended to decrease with both increasing grain size and increasing strain rate. The results are discussed in terms of the deformation mechanisms which lead to the observed behavior.

MP 1908

TENSILE STRENGTH OF MULTI-YEAR PRESSURE RIDGE SEA ICE SAMPLES.

Cox, G.F.N., et al, *Journal of energy resources technology*, Sep. 1985, 107(3), p.375-380, 20 refs.
Richter-Menge, J.A.
40-364
PRESSURE RIDGES, ICE STRENGTH, TENSILE PROPERTIES, SEA ICE, STRAINS, TESTS.

Thirty-six constant strain-rate uniaxial tension tests were performed on vertically oriented multi-year pressure ridge samples from the Beaufort Sea. The tests were performed on a closed-loop electro-hydraulic testing machine at two strain rates (1/10,000 and 1/1,000/s) and two temperatures (-20 and -5 C). This paper summarizes the sample preparation and testing techniques used in the investigation and presents data on the tensile strength, initial tangent modulus, and failure strain of the ice.

MP 1909

COMPARISON OF SPOT SIMULATOR DATA WITH LANDSAT MSS IMAGERY FOR DELINEATING WATER MASSES IN DELAWARE BAY, BROADKILL RIVER, AND ADJACENT WETLANDS.

Ackleson, S.G., et al, *Photogrammetric engineering and remote sensing*, Aug. 1985, 60(8), p.1123-1129, 5 refs.
Klemas, V., McKim, H.L., Merry, C.J.
40-400
WATER RESERVES, REMOTE SENSING, HYDRODYNAMICS, RADIOMETRY, LANDSAT, WATER FLOW, DELAWARE BAY.

The radiometric and spatial qualities of SPOT simulator and Landsat-3 MSS data are compared as to their ability to distinguish different water masses within Delaware Bay and adjacent wetland areas. The SPOT simulator data contain a greater range of gray level values for all water areas than do the Landsat MSS data. The greater spatial resolution of the SPOT simulator data provides information about small-scale hydrodynamics not available on the Landsat MSS data. Both types of data show a plume of spectrally unique water flowing from Roosevelt Inlet into Delaware Bay. The plume is most visible in SPOT simulator band 1 (500-590 nm) and Landsat MSS band 4 (500-600 nm). In both bands, the plume appears dark relative to the surrounding Delaware Bay water. Recent hydrographic surveys characterize the plume as an ebb tidal feature with high concentrations of dissolved and particulate organic matter believed to originate from the adjacent Canary Creek Marsh and Great Marsh. SPOT simulator data are found to delineate water masses with a high degree of separation. Radiometrically degraded SPOT data produce similar results. Landsat-3 MSS data, although useful for delineating water masses, do not produce good separation because of sensor noise.

MP 1910

SIMULATED SEA ICE USED FOR CORRELATING THE ELECTRICAL PROPERTIES OF THE ICE WITH ITS STRUCTURAL AND SALINITY CHARACTERISTICS.

Gow, A.J., International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, Oct. 7-9, 1985. Digest, Vol. 1. New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p.76-82.
40-409
ICE ELECTRICAL PROPERTIES, SEA ICE, ICE CRYSTAL STRUCTURE, ICE SALINITY, REMOTE SENSING, REFLECTIVITY, ICE COVER THICKNESS, ICE GROWTH, EXPERIMENTATION.

MP 1911

DIELECTRIC PROPERTIES AT 4.75 GHZ OF SALINE ICE SLABS.

Arcone, S.A., et al, International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, Oct. 7-9, 1985. Digest, Vol. 1, New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p.83-86, 10 refs.
McGrew, S.G.
40-410
ICE ELECTRICAL PROPERTIES, SEA ICE, ICE SALINITY, MICROWAVES, DIELECTRIC PROPERTIES, RADIOMETRY, BRINES, EXPERIMENTATION.

The complex relative dielectric permittivity of saline ice slabs removed from an artificially grown ice sheet has been measured at 4.75 GHz as a function of temperature. The frequency lies within the range used by other researchers who conducted radiometric tests concurrently on the same ice sheet. The slabs were placed between open waveguide radiators and dielectric properties calculated from the forward scattering coefficient. The results show both real (k') and imaginary (k") parts to vary almost in direct proportion to the brine volume. However, the values for k" show more variation, probably due to scattering.

MP 1912

LABORATORY STUDIES OF ACOUSTIC SCATTERING FROM THE UNDERSIDE OF SEA ICE.

Jezek, K.C., et al, International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, Oct. 7-9, 1985. Digest, Vol. 1. New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p.87-91.
Gow, A.J., Stanton, T.K.
40-411
ICE ACOUSTICS, ICE BOTTOM SURFACE, SEA ICE, ACOUSTIC SCATTERING, ATTENUATION, REMOTE SENSING, ACOUSTIC MEASUREMENT.

An analysis has shown that: reflection coefficient for growing ice is about .06. This coefficient increases dramatically as the ice decays. At frequencies above 100 kHz, scattering is dominated by the dendrites at the base of the ice. Fluctuations in normal incidence echoes are significant above 100 kHz. Backscatter from the underside of sea ice does not change significantly as the ice grows out of the melt (0 to 10 cm thick). Attenuation is found to be far greater than the attenuation reported by Langleben who performed measurements horizontally and away from the dendritic layer (same acoustic frequencies).

MP 1913

100 MHZ DIELECTRIC CONSTANT MEASUREMENTS OF SNOW COVER: DEPENDENCE ON ENVIRONMENTAL AND SNOW PACK PARAMETERS.

Burns, B.A., et al, International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, Oct. 7-9, 1985. Digest, Vol. 2, New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p.829-834, 3 refs.

Larson, R.W., Onstott, R.G., Fisk, D.J.

40-420

SNOW COVER DISTRIBUTION, SNOW ELECTRICAL PROPERTIES, REMOTE SENSING, MICROWAVES, DIELECTRIC PROPERTIES, SNOW DEPTH, SNOW WATER CONTENT, SURFACE ROUGHNESS, SNOW TEMPERATURE, SNOW DENSITY.

Snow cover of both land and ocean (sea ice) areas presents a challenge to remote sensing. On one hand, it acts as a mask over surfaces of interest and part of the remote sensing problem is then to determine whether the snow cover is transparent, opaque, or partially transparent resulting in an ambiguous signature. On the other hand, the properties of the snow cover itself may be of interest, such as depth, snow water equivalent and coverage. Microwave remote sensors in particular have potential to monitor these properties because of their capabilities to penetrate the surface, detect small wetness differences and operate in all weather conditions (Foster, et al., 1985). To realize this potential, it is necessary to understand how snow properties affect remote sensing signatures. Microwave signatures of snow are a function of dielectric constant as well as surface roughness and depth. A primary objective therefore is to determine the relationship between the dielectric constant and environmental parameters, including physical properties of the snow cover and local meteorological variables.

MP 1914

ICE CONDITIONS ON THE OHIO AND ILLINOIS RIVERS, 1972-1985.

Gatto, L.W., International Geoscience and Remote Sensing Symposium (IGARSS '85), Amherst, MA, Oct. 7-9, 1985. Digest, Vol. 2, New York, Institute of Electrical and Electronics Engineers, Inc., 1985, p.856-861, 3 refs.

40-424

RIVER ICE, ICE CONDITIONS, ICE FORECASTING, REMOTE SENSING, MAPPING, AERIAL SURVEYS, UNITED STATES—OHIO RIVER, UNITED STATES—ILLINOIS RIVER.

MP 1915

SHEET ICE FORCES ON A CONICAL STRUCTURE: AN EXPERIMENTAL STUDY.

Sodhi, D.S., et al, Arctic Energy Technologies Workshop, Morgantown, WV, Nov. 14-15, 1984. Proceedings, U.S. Department of Energy, Morgantown Energy Technology Center, DOE/METC-85/6014, Apr. 1985, p.46-54, DE85003360, 11 refs.

Morris, C.E., Cox, G.F.N.

40-644

ICE PRESSURE, OFFSHORE STRUCTURES, ICE LOADS, FLEXURAL STRENGTH, ICE COVER THICKNESS, ICE FRICTION, ICE SHEETS, SURFACE PROPERTIES, ICE MECHANICS, VELOCITY.

Small-scale experiments were performed to determine sheet ice forces on a conical structure. The experiments were conducted with a 45 deg, upward-breaking conical structure which had diameters of 1.5 m at the waterline and 0.33 m at the top. The surface of the structure was initially smooth; later it was roughened to investigate the effect of surface friction on the ice load. The thickness and the flexural strength of ice sheets were varied, and the tests were conducted at three fixed velocities. The measured ice forces agree well with the forces predicted by plastic limit analysis. There is no effect of velocity on the ice forces for tests conducted for a low coefficient of friction (0.1), whereas some velocity effect on the horizontal ice forces is found for tests conducted with the rough surface having a coefficient of friction equal to 0.5. The horizontal ice forces are higher at lower velocities. The size of the broken ice pieces, determined from a power spectrum analysis of the horizontal ice force records, was found to be about one-third of the characteristic length.

MP 1916

MEASURING MULTI-YEAR SEA ICE THICKNESS USING IMPULSE RADAR.

Kovacs, A., et al, Arctic Energy Technologies Workshop, Morgantown, WV, Nov. 14-15, 1984. Proceedings, U.S. Department of Energy, Morgantown Energy Technology Center, DOE/METC-85/6014, Apr. 1985, p.55-67, DE85003360, 6 refs.

Morey, R.M.

40-645

ICE COVER THICKNESS, REMOTE SENSING, ICE BOTTOM SURFACE, ICE STRUCTURE, RADAR ECHOES, SEA ICE, ICE DETECTION, BRINES, ICE ELECTRICAL PROPERTIES.

Sounding of multi-year sea ice, using impulse radar operating in the 80- to 500-MHz frequency band, revealed that the bottom of this ice could not always be detected. It was found that the bottom of the ice could not be detected where the ice structure had a high brine content. Because of brine's high conductivity, brine volume dominates the loss mechanism in first-year sea ice, and the same was found true for multi-year sea ice. Preliminary findings also indicate that a representative value for the apparent bulk dielectric constant of multi-year sea ice is 3.5. This represents an effective EM wavelet velocity of 0.16 m/ns, which may be used to estimate multi-year sea ice thickness in cases where the ice bottom is detected in ice profile data.

MP 1917

PRELIMINARY SIMULATION STUDY OF SEA ICE INDUCED GOUGES IN THE SEA FLOOR.

Weeks, W.F., et al, Arctic Energy Technologies Workshop, Morgantown, WV, Nov. 14-15, 1984. Proceedings, U.S. Department of Energy, Morgantown Energy Technology Center, DOE/METC-85/6014, Apr. 1985, p.126-135, DE85003360, 16 refs.

Tucker, W.B., Niedoroda, A.W.

40-651

ICE SCORING, SEDIMENT TRANSPORT, OCEAN BOTTOM, BOTTOM TOPOGRAPHY, GRAIN SIZE, BOTTOM SEDIMENT, BEAUFORT SEA.

A simulation model for sea ice-induced gouges on the shelf of the Beaufort Sea is developed by assuming that the annual occurrence of new gouges is given by a Poisson distribution, the locations of the gouges are random, and the distribution of gouge depths is specified by an exponential distribution. Once a gouge is formed it is subject to infilling by transport of sediment into the region and by local movement of sediment along the sea floor. These processes are modeled by assuming a sediment input based on stratigraphic considerations and by calculating bed-load transport using methods from sediment transport theory. It is found that if currents are sufficient to transport sediment, rapid infilling of gouges occurs. In that these threshold currents are small for typical grain sizes on the Beaufort Shelf, this suggests that the gouging record commonly represents only a few tens of years.

MP 1918

MAPPING RESISTIVE SEABED FEATURES USING DC METHODS.

Sellmann, P.V., et al, Arctic Energy Technologies Workshop, Morgantown, WV, Nov. 14-15, 1984. Proceedings, U.S. Department of Energy, Morgantown Energy Technology Center, DOE/METC-85/6014, Apr. 1985, p.136-147, DE85003360, 6 refs.

Delaney, A.J., Arcone, S.A.

40-652

SUBSEA PERMAFROST, OCEAN BOTTOM, BOTTOM SEDIMENT, SOIL STRENGTH, ELECTRIC EQUIPMENT, MAPPING, MODELS.

Geophysical field observations of apparent resistivity using Wenner and dipole-dipole electrode arrays were made at several New England coastal sites The objective was to assess the performance of these systems in detecting resistive seabed features as an indication of their potential for subsea permafrost mapping. Two sites on the Maine coast were used for observations on bedrock below a thin layer of sediments. A seaborne survey was then conducted in New Haven Harbor, Connecticut, at a site where the depth to bedrock below the seabed had been mapped by seismic methods and drilling several years earlier (U.S. Army Corps of Engineers 1981). The data gathered helped to define the range of apparent resistivity values expected in areas of subsea permafrost, the effect of water depth on the quality of a survey, and the vertical and lateral resolution capabilities of the arrays used. Good qualitative agreement between rock depth and resistivity was observed, even with rock depths up to 50 m below the seabed. Data were also collected in areas where seismic methods had been unable to extract subbottom information due to the gas content of local organic sediments.

MP 1919

RECONSIDERATION OF THE MASS BALANCE OF A PORTION OF THE ROSS ICE SHELF, ANTARCTICA.

Jezek, K.C., et al, *Journal of glaciology,* 1984, 30(106), p.381-384, 6 refs., With French and German summaries.

Bentley, C.R.

39-3793

ICE SHELVES, GROUNDED ICE, MASS BALANCE, ANTARCTICA—ROSS ICE SHELF.

The identification of a small region of grounded ice in the north-western sector of the Ross Ice Shelf has forced a re-evaluation of the mass-balance calculations carried out by Thomas and Bentley (1978). Those authors concluded that the Ross Ice Shelf up-stream of Crary Ice Rise was thickening, but they did not take into account the effects on the velocity field of grounded ice which is located near the input gate to their volume element. Reasonable estimates of the degree to which the ice velocity just up-stream of the grounded ice is diminished indicate that it is no longer possible to conclude that the ice shelf is thickening using Thomas and Bentley's original flow band. Therefore, a new flow band was chosen which was grid east of Thomas and Bentley's band and unaffected by any nearby grounded areas. The mass balance in this flow band was found to be zero within experimental error; a difference exceeding about 0.2 m/a in magnitude between the thickening and bottom freeze-on rates is unlikely. (Auth.)

MP 1920

PREFERENTIAL DETECTION OF SOUND BY PERSONS BURIED UNDER SNOW AVALANCHE DEBRIS AS COMPARED TO PERSONS ON THE OVERLYING SURFACE.

Johnson, J.B., International Snow Science Workshop, Aspen, CO, Oct. 24-27, 1984. Proceedings, Aspen, CO, ISSW Workshop Committee, [1984], p.42-47, 8 refs.

40-801

RESCUE OPERATIONS, AVALANCHE DEPOSITS, DETECTION, SNOW ACOUSTICS, SNOW COVER EFFECT, SOUND WAVES, ATTENUATION.

The preferential detection of sound by a person buried under snow can be explained by the strong attenuation of acoustic waves in snow and the relatively higher level of background acoustic noise that exists for persons above the snow surface as compared to an avalanche burial victim. This noise masks sound transmitted to persons on the snow surface causing a reduction of hearing sensitivity as compared to the burial victim. Additionally, the listening concentration of a buried individual is generally greater than for persons working on the snow surface, increasing their subjective awareness of sound.

MP 1921

NEW CLASSIFICATION SYSTEM FOR THE SEASONAL SNOW COVER.

Colbeck, S.C., International Snow Science Workshop, Aspen, CO, Oct. 24-27, 1984. Proceedings, Aspen, CO, ISSW Workshop Committee, [1984], p.179-181, 3 refs.

40-825

SNOW CRYSTAL STRUCTURE, METAMORPHISM (SNOW), SNOW WATER CONTENT, FREEZE THAW CYCLES, CLASSIFICATIONS, ICE CRYSTAL GROWTH, SNOW MELTING, SNOW COVER, GRAIN SIZE.

It is necessary to assign terms to snow crystals so that we can refer to them at any time. TCSI (1954) suggested five classes of snow crystals but many important types of crystals were not included. Sommerfeld (1969) and then Sommerfeld and LaChapelle (1970) suggested a classification based on processes because, if the processes could be correctly identified, information would be provided about both crystal shapes and metamorphic processes. Unfortunately, many of the names used—equitemperature, temperature gradient, and melt-freeze—can misrepresent the processes responsible for generating those shapes. Other terms are suggested here in hopes of correctly describing snow crystals. Only the major categories are dealt with here; a more detailed classification will be published later.

MP 1922

REVIEW OF ANALYTICAL METHODS FOR GROUND THERMAL REGIME CALCULATIONS.

Lunardini, V.J., Thermal design considerations in frozen ground engineering. Edited by T.G. Krzewinski and R.G. Tart, Jr., New York, NY, American Society of Civil Engineers, 1985, p.204-257, 33 refs.

40-630

PERMAFROST THERMAL PROPERTIES, FROZEN GROUND TEMPERATURE, THERMAL REGIME, HEAT TRANSFER, STRUCTURES, HEAT BALANCE, PHASE TRANSFORMATIONS, STEFAN PROBLEM, ANALYSIS (MATHEMATICS).

MP 1923
THAWING OF FROZEN CLAYS.
Anderson, D.M., et al, Freezing and thawing of soil-water systems. Edited by D.M. Anderson and P.J. Williams, New York, NY, American Society of Civil Engineers, 1985, p.1-9, 11 refs.
Tice, A.R.
40-612
GROUND THAWING, CLAYS, SOIL WATER MIGRATION, GROUND ICE, ICE NUCLEI, POROUS MATERIALS, LATENT HEAT, UNFROZEN WATER CONTENT, ICE CRYSTALS, TEMPERATURE EFFECTS, PHASE TRANSFORMATIONS.

MP 1924
PARTIAL VERIFICATION OF A THAW SETTLEMENT MODEL.
Guymon, G.L., et al, Freezing and thawing of soil-water systems. Edited by D.M. Anderson and P.J. Williams, New York, NY, American Society of Civil Engineers, 1985, p.18-25, 6 refs.
Berg, R.L., Ingersoll, J.
40-614
GROUND THAWING, SETTLEMENT (STRUCTURAL), HEAT TRANSFER, MOISTURE TRANSFER, FROST HEAVE, FREEZE THAW CYCLES, MODELS, THAW WEAKENING, TESTS.

Results from a one-dimensional model that estimates frost heave and thaw settlement are compared to laboratory soil column data. The model is based upon well known equations that describe heat and moisture flow in soils. Processes in freezing or thawing zones are approximated by a lumped isothermal heat budget approach as well as phenomenological equations that account for overburden effects and reduced fluid movement due to ice formation. Laboratory soil column data were obtained for one-dimensional freezing and then thawing of a silt soil. The model results accurately estimate temperature distributions and pore water pressures during thawing.

MP 1925
HYDRAULIC PROPERTIES OF SELECTED SOILS.
Ingersoll, J., et al, Freezing and thawing of soil-water systems. Edited by D.M. Anderson and P.J. Williams, New York, NY, American Society of Civil Engineers, 1985, p.26-35, 4 refs.
Berg, R.L.
40-615
SOIL WATER, FROST HEAVE, SETTLEMENT (STRUCTURAL), FREEZE THAW CYCLES, PAVEMENTS, TENSILE PROPERTIES, SOIL STRUCTURE, GRAIN SIZE, MATHEMATICAL MODELS.

The method and equipment used to coincidentally determine the hydraulic conductivity versus soil moisture tension and soil moisture tension versus moisture content relationships are described. Over 30 soils have been tested, including gravels, sands, silts and clays. Most of the work has been conducted at soil moisture tensions less than 100 kPa (1 bar), but a few moisture retention curves extend to about 12 bars of soil moisture suction. Results for one soil from each type are described and discussed in detail. Grain size distributions and the two hydraulic relationships are shown for each of the four soils. An equation suggested by Gardner is used to approximate both relationships. Coefficients for Gardner's equations for several different soils have been obtained and are tabulated.

MP 1926
MODEL FOR DIELECTRIC CONSTANTS OF FROZEN SOILS.
Oliphant, J.L., Freezing and thawing of soil-water systems. Edited by D.M. Anderson and P.J. Williams, New York, NY, American Society of Civil Engineers, 1985, p.46-57, 17 refs.
40-617
FROZEN GROUND PHYSICS, SOIL COMPOSITION, GROUND THAWING, UNFROZEN WATER CONTENT, DIELECTRIC PROPERTIES, TEMPERATURE EFFECTS, NUCLEAR MAGNETIC RESONANCE.

The dielectric constant of frozen soils is made up of contributions from each phase—mineral, ice, air and liquid water—in the soil. The apparent dielectric constants of three soils, a kaolinite, Morin clay and Palouse silt-loam, were measured under both thawed and frozen conditions at various temperatures and various water contents using time domain reflectometry (TDR). Nuclear magnetic resonance (NMR) was used to measure the unfrozen water contents of these soils at subfreezing temperatures. The NMR data were used to calculate the volume fractions of the ice and liquid water phases in the TDR experiments. It was found that a mixing model for the apparent dielectric constant of the soil samples assuming spherical air, ice and minderal inclusions in a water matrix was able to closely fit the TDR data. To obtain the best fit it was necessary to use an average dielectric constant for water somewhat less than that for bulk water. The mixing model can be used for the interpretation of TDR data obtained in the field. This allows for the measurement of unfrozen water contents using TDR at temperatures just below 0 C, where the liquid water phase makes up a significant portion of the TDR signal.

MP 1927
FROST HEAVE OF FULL-DEPTH ASPHALT CONCRETE PAVEMENTS.
Zomerman, I., et al, Freezing and thawing of soil-water systems. Edited by D.M. Anderson and P.J. Williams, New York, NY, American Society of Civil Engineers, 1985, p.66-76, 12 refs.
Berg, R.L.
40-619
FROST HEAVE, PAVEMENTS, BITUMINOUS CONCRETES, THAW WEAKENING, SOIL WATER, SOIL STRUCTURE, FROST PENETRATION, GRAIN SIZE, TESTS, HEAT TRANSFER, MOISTURE TRANSFER, FROST RESISTANCE.

During 1984 and early 1985 frost penetration, frost heave and thaw weakening were monitored on two full-depth test sections at CRREL. The subgrade soil beneath one test section was a lean clay and the subgrade soil beneath the second test section was Hanover silt. Laboratory frost susceptibility tests were conducted for each soil, as were moisture retention curves and curves relating moisture content and unsaturated hydraulic conductivity. Results from the laboratory tests were used with FROST1B, a coupled heat and mass flow computer model, to simulate performance of the field test sections. FROST1B had never been applied to a cohesive soil similar to the lean clay. Results from model simulations on both soils agreed well, i.e. within about 15% with field measurements of frost heave and frost penetration with time.

MP 1928
CREEP STRENGTH, STRAIN RATE, TEMPERATURE AND UNFROZEN WATER RELATIONSHIP IN FROZEN SOIL.
Fish, A.M., International Symposium on Ground Freezing, 4th, Sapporo, Japan, Aug. 5-7, 1985. Proceedings, Vol.2, [Rotterdam, A.A. Balkema, 1985], p.29-36, 32 refs.
40-661
FROZEN GROUND STRENGTH, SOIL CREEP, STRAINS, FROZEN GROUND TEMPERATURE, UNFROZEN WATER CONTENT, FROZEN GROUND PHYSICS, COMPRESSIVE PROPERTIES, TEMPERATURE EFFECTS, ANALYSIS (MATHEMATICS).

A relationship was developed between maximum (peak) strength, strain rate, strain, and temperature using data on uniaxial compression of remolded frozen Fairbanks silt obtained in the temperature range from -0.5 to -10 C at constant strain rates (CSR) that varied between 1/100 and 1/1,000,000/s. It is shown that three principal parameters of frozen soil define the magnitude of strength at a given strain rate: the instantaneous strength, the activation energy, and the strain hardening parameter all relate to each other. Their absolute values depend upon temperature and are linked with the simplest physical characteristics of soil and especially the ice and unfrozen water contents. The activation energy of frozen soil is presented as a sum of two components: activation energy of the soil skeleton and activation energy of the unfrozen water. The activation energy of frozen soil varied due to the changes of unfrozen water content between 16.6 and 13.2 kcal/mole.

MP 1929
PREDICTION OF UNFROZEN WATER CONTENTS IN FROZEN SOILS BY A TWO-POINT OR ONE-POINT METHOD.
Xu, X., et al, International Symposium on Ground Freezing, 4th, Sapporo, Japan, Aug. 5-7, 1985. Proceedings, Vol.2, [Rotterdam, A.A. Balkema, 1985], p.83-87, 5 refs.
Oliphant, J.L., Tice, A.R.
40-669
FROZEN GROUND, UNFROZEN WATER CONTENT, DENSITY (MASS/VOLUME), TEMPERATURE EFFECTS.

The unfrozen water content in frozen soils, with different initial water content, dry density and molality, was determined by the nuclear magnetic resonance technique. Results show that the unfrozen water content in frozen morin clay changes with the initial water content and the dry density only within a range of three percent of the dry soil weight, and increases with the increase in the molality linearly because of the linear freezing point depression. The curves of the unfrozen water content vs temperature are quite parallel with the change in the initial water content and rotate a little bit counterclockwise with the increase in the dry density. On the basis of the data mentioned above, a two-point method by the measurements of two freezing points at two different initial water contents, and a one-point method by the measurement of the unfrozen water content at -1 C if the initial water content and its freezing point are given, is presented. Errors of predicting the unfrozen water content are 1-3% on the average for the two-point method and 1% or so for the one-point method.

MP 1930
FROST JACKING FORCES ON H AND PIPE PILES EMBEDDED IN FAIRBANKS SILT.
Johnson, J.B., et al, International Symposium on Ground Freezing, 4th, Sapporo, Japan, Aug. 5-7, 1985. Proceedings, Vol.2, [Rotterdam, A.A. Balkema, 1985], p.125-133, 5 refs.
Esch, D.C.
40-676
FROST HEAVE, PILE EXTRACTION, PIPELINE SUPPORTS, SHEAR STRESS, PERMAFROST DISTRIBUTION, FOUNDATIONS, TEMPERATURE EFFECTS, FROZEN GROUND MECHANICS, FROST PENETRATION, COUNTERMEASURES.

The magnitude and variation of forces and shear stresses, caused by soil frost heaving, for a pipe pile and an H pile were determined as a function of depth along the upper 3 m of the piles for two consecutive winters. The maximum frost heaving forces on the H pile during each winter were 943 kN and 899 kN. The maximum frost heaving force on the pipe pile was 703 kN. Maximum local shear stresses for the H pile were 1 MPa and 903 kPa for the two winters. The maximum local shear stress for the pipe pile was 896 kPa. Maximum average shear stresses over the two winters were 324 kPa and 427 kPa for the H pile and 324 kPa for the pipe pile. Maximum heaving forces and shear stresses occurred during periods of maximum cold and soil surface heave magnitude. These were not related to the depth of frost for most of the winter since the soil was frozen completely to the permafrost table.

MP 1931
SHEAR STRENGTH ANISOTROPY IN FROZEN SALINE AND FRESHWATER SOILS.
Chamberlain, E.J., International Symposium on Ground Freezing, 4th, Sapporo, Japan, Aug. 5-7, 1985. Proceedings, Vol.2, [Rotterdam, A.A. Balkema, 1985], p.189-194, 2 refs.
40-687
FROZEN GROUND STRENGTH, SHEAR STRENGTH, ANISOTROPY, SALINITY, CLAY SOILS, SANDS, TESTS.

The shear strength anisotropy of frozen freshwater and seawater clay and sand soils was investigated using the direct shear technique. Samples were sheared at angles of 0, 30, 60 and 90 degrees between the shear and freezing planes. Because of variations in sample density, there was considerable scatter in the data. This scatter and the relationship of the maximum shear strength to the angle between the shear and freezing planes were accounted for by conducting multiple linear regression analysis on empirical equations relating the test variables to the shear strength.

MP 1932
SOIL-WATER POTENTIAL AND UNFROZEN WATER CONTENT AND TEMPERATURE.
Xu, X., et al, *Journal of glaciology and geocryology,* 1985, 7(1), p.1-14, 8 refs., In Chinese with English summary.
Oliphant, J.L., Tice, A.R.
40-783
FROZEN GROUND TEMPERATURE, NUCLEAR MAGNETIC RESONANCE, UNFROZEN WATER CONTENT, SOIL WATER, SOIL STRUCTURE, WATER CONTENT, FREEZING POINTS, SOIL CHEMISTRY, SOIL TEMPERATURE, DENSITY (MASS/VOLUME).

Soil-water potential was determined by the extraction method and four factors affecting the soil-water potential, including water content, soil type, dry density and temperature, were investigated. The unfrozen water content of frozen soils was determined by the pulsed nuclear magnetic resonance technique and three factors affecting the unfrozen water content, including initial water content, dry density and salt concentration, were investigated. Results have shown that the soil-water potential in the unsaturated, unfrozen soils decreases both with the decrease in the water content and with the increase in the dispersion of the soil and increases with the increases in the dry density and temperature. The unfrozen water content of frozen soils changes slightly with the initial water content and the dry density within the range of 3% for the morin clay and increases sharply with the increase in the salt concentration.

MP 1933
EFFECTS OF SOLUBLE SALTS ON THE UNFROZEN WATER CONTENTS OF THE LANZHOU, PRC, SILT.
Tice, A.R., et al, *Journal of glaciology and geocryology,* June 1985, 7(2), p.99-109, In Chinese with English summary., 20 refs. For English version see 39-2916.
Zhu, Y., Oliphant, J.L.
40-830
UNFROZEN WATER CONTENT, FROZEN GROUND PHYSICS, SALINE SOILS, ELECTRICAL RESISTIVITY, SOIL CHEMISTRY.

Phase composition curves are presented for a typical saline silt from Lanzhou and compared to some silts from Alaska. The unfrozen water content of the Chinese silt is much higher than the Alaskan silts. This higher amount is due to the large amount of soluble salts present in the silts from China which are not present in the silts from interior Alaska. When the salts are removed, the unfrozen water contents are then similar for the Chinese and Alaskan silts. We have introduced a technique for correcting the unfrozen water content of partially frozen soils due to high salt concentrations. This correction is possible by calculating the modality of the unfrozen water at each temperature from a measurement of the electrical conductivity of the extract of a saturated paste.

MP 1934

WATER MIGRATION IN UNSATURATED FROZEN MORIN CLAY UNDER LINEAR TEMPERATURE GRADIENTS.

Xu, X., et al, *Journal of glaciology and geocryology,* June 1985, 7(2), p.111-122, 14 refs., In Chinese with English summary.
Oliphant, J.L., Tice, A.R.
40-831
SOIL WATER MIGRATION, CLAY SOILS, FROZEN GROUND PHYSICS, SATURATION, TEMPERATURE GRADIENTS.

MP 1935

PRESSURE RIDGE MORPHOLOGY AND PHYSICAL PROPERTIES OF SEA ICE IN THE GREENLAND SEA.

Tucker, W.B., et al, Arctic Oceanography Conference and Workshop, Hattiesburg, MS, June 11-14, 1985. Proceedings, U.S. Department of the Navy, 1985, p.214-223, 13 refs.
Gow, A.J., Weeks, W.F.
40-957
PRESSURE RIDGES, ICE STRUCTURE, ICE PHYSICS, SEA ICE, SALINITY, GROUNDED ICE, ICE CRYSTAL STRUCTURE, ICE FLOES, GREENLAND SEA.

Field investigations of pressure ridge sails have shown that ridge height is limited by the thickness of the ice that deformed. Sail height and width can be conveniently expressed as functions of the thickness of the ice blocks contained in the ridge. Surface dimensions of the blocks are also related to ice thickness. Ridge height may be determined by the ability of the parent sheet to support the loading imposed by the ridge or by the type of failure occurring. Some insight into the structure of ridge keels may result from detailed study of the sails. The physical properties of sea ice in the Fram Strait region of the Greenland Sea were examined as part of the MIZEX field program in 1984. The properties measured at each sampling site included salinity, temperature, thickness, crystal structure and snow depth. The measured salinities agreed well with those measured elsewhere in the Arctic during summer. Crystal texture analysis indicated that about 75% of the ice consisted of columnar type crystal structure. The remaining 25% consisted of granular ice.

MP 1936

MECHANICAL PROPERTIES OF MULTI-YEAR PRESSURE RIDGE SAMPLES.

Richter-Menge, J.A., Arctic Oceanography Conference and Workshop, Hattiesburg, MS, June 11-14, 1985. Proceedings, U.S. Department of the Navy, 1985, p.244-251, 19 refs.
40-960
PRESSURE RIDGES, ICE MECHANICS, COMPRESSIVE PROPERTIES, TENSILE PROPERTIES, ICE DENSITY, MECHANICAL TESTS, SALINITY.

Over 500 laboratory tests have recently been completed on ice samples collected from multi-year pressure ridges in the Alaskan Beaufort Sea. Tests were performed in uniaxial constant-strain-rate compression and tension and in confined compression. The tests were conducted at two temperatures, -5 and -20 C, and four strain rates ranging from 1/100 to 1/100,000/s. This discussion summarizes the sample preparation and testing techniques used in the investigation and presents data on the compressive, tensile and confined compressive strength of multi-year ridge samples. This information is necessary for designing arctic structures and vessels that must withstand the impact of a multi-year pressure ridge.

MP 1937

EXPERIENCE WITH A BIAXIAL ICE STRESS SENSOR.

Cox, G.F.N., Arctic Oceanography Conference and Workshop, Hattiesburg, MS, June 11-14, 1985. Proceedings, U.S. Department of the Navy, 1985, p.252-258, 10 refs.
40-961
ICE PRESSURE, ICE STRENGTH, STRESSES, LOADS (FORCES), OFFSHORE STRUCTURES, ICE MECHANICS, ICE LOADS, TESTS, SEA ICE, ICE NAVIGATION.

A biaxial ice stress sensor has been developed to measure the magnitude and direction of the principal stresses in an ice sheet. Controlled laboratory tests indicate that the sensor has a resolution of 20 kPa and an accuracy of better than 10% under a variety of loading conditions. The sensor has been successfully used to measure thermal ice pressures in lakes and ice loads on a caisson-retained island in the Beaufort Sea.

MP 1938

NUMERICAL SIMULATION OF SEA ICE INDUCED GOUGES ON THE SHELVES OF THE POLAR OCEANS.

Weeks, W.F., et al, Arctic Oceanography Conference and Workshop, Hattiesburg, MS, June 11-14, 1985. Proceedings, U.S. Department of the Navy, 1985, p.259-265, 16 refs.
Tucker, W.B.
40-962
ICE SCORING, COMPUTER PROGRAMS, MATHEMATICAL MODELS, ICE SHELVES, SEA ICE, SEDIMENT TRANSPORT, OCEAN BOTTOM, DISTRIBUTION, STATISTICAL ANALYSIS, STRATIGRAPHY, OCEAN CURRENTS.

A simulation model for sea ice-induced gouges on the shelves of the polar seas is developed by assuming that the annual occurrence of new gouges is given by a Poisson distribution, the locations of the gouges are random, and the distribution of gouge depths is specified by an exponential distribution. Once a gouge is formed it is infilled by assuming a sediment input based on stratigraphic considerations and by calculating bed-load transport using methods from sediment transport theory. If currents are sufficient to transport sediment, rapid infilling of gouges occurs. In that these threshold currents are small for typical grain sizes, this suggests that the gouging record commonly represents only a few tens of years.

MP 1939

TEMPERATURE DEPENDENCE OF THE EQUILIBRIUM FORM OF ICE.

Colbeck, S.C., *Journal of crystal growth,* Sep. 1985, 72(3), p.726-732, 25 refs.
40-981
ICE CRYSTAL GROWTH, ICE CRYSTAL STRUCTURE, SNOW CRYSTAL STRUCTURE, TEMPERATURE EFFECTS, PLATES, SURFACE ROUGHNESS, EXPERIMENTATION.

Individual crystals are grown under controlled conditions at temperatures between -0.6 and -20 C at rates as low as 1/10,000 g/year and supersaturations as low as 6.5 x 1/10,000,000. The transition between the kinetic growth form and the equilibrium form is clearly distinguished at temperatures between -2 and -10 C where the equilibrium form is a well-rounded plate with an aspect ratio of about 2.5. At temperatures below -11 C the equilibrium form is a hexagonal prism of about the same aspect ratio. This transition coincides with the rapid increase in surface roughening on the prism faces at temperatures above -10 C. The equilibrium form is a fully rounded particle just below 0 C although we had expected the fully rounded particle to prevail down to at least -5 C. Furthermore, there are unresolved differences between these experimental results and observations of crystals from the seasonal snow cover where particles are fully rounded at slow growth rates and low temperatures.

MP 1940

ICE JAM FLOOD PREVENTION MEASURES: LAMOILLE RIVER AT HARDWICK, VERMONT, USA.

Calkins, D.J., International Conference on the Hydraulics of Floods and Flood control, 2nd, Cambridge, England, Sep. 24-26, 1985. Proceedings, Cranfield, Bedford, England, BHRA, The Fluid Engineering Centre, 1985, p.149-168, 4 refs.
40-1012
ICE CONTROL, ICE JAMS, RIVER ICE, FLOODS, WATER LEVEL, TOPOGRAPHIC EFFECTS, COUNTERMEASURES.

Prevention of ice-induced flooding is very difficult, but the impact can be minimized if the winter ice regime can be altered. The Lamoille River at Hardwick, Vermont, is a steep, shallow stream during non-ice periods. Under ice jam conditions stage increases of 1-2 m above the elevation of the floodplain have been measured. Several experimental measures have been implemented to minimize the ice jam flood levels; their performance was evaluated for the winter of 1983-84.

MP 1941

GEOPHYSICAL SURVEY OF SUBGLACIAL GEOLOGY AROUND THE DEEP-DRILLING SITE AT DYE 3, GREENLAND.

Jezek, K.C., et al, *American Geophysical Union. Geophysical monograph series,* 1985, No.33, p.105-110, 14 refs.
Roeloffs, E.A., Greischar, L.L.
39-3575
GEOPHYSICAL SURVEYS, GLACIER BEDS, GLACIAL GEOLOGY, SUBGLACIAL OBSERVATIONS, BOREHOLES, TOPOGRAPHIC FEATURES, GEOMORPHOLOGY, RADAR ECHOES, TECTONICS, GREENLAND.

MP 1942

SIMPLE DESIGN PROCEDURE FOR HEAT TRANSMISSION SYSTEM PIPING.

Phetteplace, G.E., Intersociety Energy Conversion Engineering Conference, 19th, San Francisco, CA, Aug. 19-24, 1984. Proceedings. Vol.3, American Nuclear Society, 1984, p.1748-1752, 4 refs.
40-1688
COST ANALYSIS, HEAT TRANSMISSION, PIPELINES, LOADS (FORCES), DESIGN, ANALYSIS (MATHEMATICS), HEATING, COOLING, HEAT LOSS.

Piping systems represent the major portion of the total cost of most district heating applications and constitute a barrier to their widespread implementation. This paper presents a methodology for least-cost design of these systems under realistic conditions of varying load. Cost-effective design of piping for district heating and cooling applications requires careful consideration of the various components of the owning and operating costs. These costs are included in the formulation of an optimization problem to determine the minimum cost design on a yearly cycle basis.

MP 1943

NITROGEN REMOVAL IN WASTEWATER STABILIZATION PONDS.

Reed, S.C., [1983], 13p. + figs., Presented at 56th Annual Conference of the Water Pollution Control Federation, Atlanta, Georgia, Oct. 2-7, 1983. Unpublished manuscript. 14 refs.
40-1089
WASTE TREATMENT, WATER TREATMENT, WATER POLLUTION, PONDS, COUNTERMEASURES, DESIGN CRITERIA, LAND RECLAMATION, CHEMICAL ANALYSIS.

A rational procedure for estimating nitrogen removal in facultative wastewater stabilization ponds has been developed and validated. The procedure, based on first order plug flow kinetics is dependent on pH, temperature and residence time. The model was developed from extensive data obtained at four facultative ponds in various parts of the U.S. and was validated with independent data from five pond systems in the U.S. and Canada. The procedure should be useful whenever system design criteria require nitrogen removal or nitrification. It should be particularly helpful for the pond component of land treatment systems when nitrogen is the limiting design parameter.

MP 1944

PROBLEMS WITH RAPID INFILTRATION—A POST MORTEM ANALYSIS.

Reed, S.C., et al, [1984], 17p. + figs., Presented at 57th Annual Conference of the Water Pollution Control Federation, New Orleans, LA, Oct. 1-4, 1984. Unpublished manuscript. 7 refs.
Crites, R.W., Wallace, A.T.
40-1086
WATER TREATMENT, WASTE TREATMENT, SEEPAGE, GROUND WATER, DESIGN, COST ANALYSIS.

Rapid infiltration is a reliable and cost effective technique for wastewater treatment. Over 300 municipal systems are in successful use in the United States. A few of the recently constructed systems have not satisfied all design expectations, particularly with respect to the amount of wastewater that can infiltrate within the time allowed. Correction of these problems often requires additional construction and increases costs but the cumulative effect is also to raise general concerns within the profession regarding the suitability and applicability of the basic concept. An analysis of the failures, and some of the problem systems was conducted and this paper will describe the results.

MP 1945

WETLANDS FOR WASTEWATER TREATMENT IN COLD CLIMATES.

Reed, S.C., et al, [1984], 9p. + figs., Presented at Water Reuse Symposium, 3rd, San Diego, CA, Aug. 26-31, 1984. Unpublished manuscript. 13 refs.
Bastian, R., Black, S., Khettry, R.
40-1087
WASTE TREATMENT, WATER TREATMENT, COLD WEATHER PERFORMANCE, WATER LEVEL, GROUND WATER, VEGETATION FACTORS, SATURATION.

MP 1946

DESIGN, OPERATION AND MAINTENANCE OF LAND APPLICATION SYSTEMS FOR LOW COST WASTEWATER TREATMENT.

Reed, S.C., [1983], 26p. + figs., Presented at Workshop on Low Cost Wastewater Treatment, Clemson, SC, Apr. 19-21, 1983. Unpublished manuscript. 3 refs.
40-1088
WASTE TREATMENT, WATER TREATMENT, SEEPAGE, VEGETATION FACTORS, DESIGN CRITERIA, LAND RECLAMATION, SATURATION.

MP 1947
INCIDENTAL AGRICULTURE REUSE APPLICATION ASSOCIATED WITH LAND TREATMENT OF WASTEWATER—RESEARCH NEEDS.
Reed, S.C., Environmental Engineering Research Council Workshop—Water Conservation and Reuse in Industry and Agriculture: Research Needs, Kiawah Island, South Carolina, Mar. 3-6, 1982. Proceedings, New York, NY, American Society of Civil Engineers, [1982], p.91-123, 34 refs.
40-1091
WASTE TREATMENT, WATER TREATMENT, LAND RECLAMATION, SEEPAGE, AGRICULTURE, VEGETATION, IRRIGATION, DESIGN, WATER POLLUTION, COUNTERMEASURES.

MP 1948
ENGINEERING SYSTEMS.
Loehr, R., et al, Workshop on Utilization of Municipal Wastewater and Sludge on Land, 1983. Proceedings. Edited by A.L. Page, L. Gleason, III, J.E. Smith, Jr., I.K. Iskandar, and L.E. Sommers, Riverside, Univerrsity of California, 1983, p.409-417, Includes discussions.
Reed, S.C.
40-1090
WASTE TREATMENT, WATER TREATMENT, SLUDGES, LAND RECLAMATION, WATER POLLUTION, COUNTERMEASURES.

MP 1949
MAINTAINING FROSTY FACILITIES.
Reed, S.C., et al, *Operations forum,* Feb. 1985, p.9-15, 6 refs.
Niedringhaus, L.
40-1240
WASTE TREATMENT, WATER TREATMENT, COLD WEATHER OPERATION, MUNICIPAL ENGINEERING, MAINTENANCE, FLOW MEASUREMENT, SEDIMENTATION, DAMAGE, SLUDGES.

MP 1950
GROWTH AND FLOWERING OF COTTONGRASS TUSSOCKS ALONG A CLIMATIC TRANSECT IN NORTHCENTRAL ALASKA.
Haugen, R.K., et al, Arctic Workshop, 13th, Boulder, CO, Mar. 15-17, 1984. [Proceedings], Boulder, University of Colorado, Institute of Arctic and Alpine Research, 1984, p.10-11, 2 refs.
Shaver, G.R., King, G.G.
40-1107
HUMMOCKS, PLANT PHYSIOLOGY, GROWTH, CLIMATIC FACTORS, AIR TEMPERATURE, PRECIPITATION (METEOROLOGY), PIPELINES, ALTITUDE, UNITED STATES—ALASKA.

MP 1951
DIELECTRIC STUDIES OF PERMAFROST USING CROSS-BOREHOLE VHF PULSE PROPAGATION.
Arcone, S.A., et al, *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* May 1985, No.85-05, Workshop on Permafrost Geophysics, Golden, Colorado, Oct. 23-24, 1984. Proceedings, p.3-5, ADA-157 485, 1 ref.
Delaney, A.J.
40-1290
PERMAFROST PHYSICS, DIELECTRIC PROPERTIES, BOREHOLES, GROUND ICE, ELECTROMAGNETIC PROPERTIES, RADAR ECHOES, WAVE PROPAGATION, SOIL STRUCTURE, PERMAFROST THERMAL PROPERTIES.

MP 1952
IMPULSE RADAR SOUNDING OF FROZEN GROUND.
Kovacs, A., et al, *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* May 1985, No.85-05, Workshop on Permafrost Geophysics, Golden, Colorado, Oct. 23-24, 1984. Proceedings, p.28-40, ADA-157 485, 1 ref.
Morey, R.M.
40-1295
FROZEN GROUND PHYSICS, RADAR ECHOES, GROUND ICE, ICE DETECTION, SOUNDING, PIPELINES, PINGOS, ELECTROMAGNETIC PROSPECTING, ICE VOLUME.

MP 1953
ANALYSIS OF WIDE-ANGLE REFLECTION AND REFRACTION MEASUREMENTS.
Morey, R.M., et al, *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* May 1985, No.85-05, Workshop on Permafrost Geophysics, Golden, Colorado, Oct. 23-24, 1984. Proceedings, p.53-60, ADA-157 485, 6 refs.
Kovacs, A.
40-1299
RADAR ECHOES, SUBSURFACE INVESTIGATIONS, DIELECTRIC PROPERTIES, REFLECTION, REFRACTION, MATHEMATICAL MODELS, WAVE PROPAGATION.

MP 1954
SOME ASPECTS OF INTERPRETING SEISMIC DATA FOR INFORMATION ON SHALLOW SUBSEA PERMAFROST.
Neave, K.G., et al, *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* May 1985, No.85-05, Workshop on Permafrost Geophysics, Golden, Colorado, Oct. 23-24, 1984. Proceedings, p.61-65, ADA-157 485, 6 refs.
Sellmann, P.V.
40-1300
SUBSEA PERMAFROST, SEISMIC SURVEYS, PERMAFROST DISTRIBUTION, SEISMIC REFRACTION, SEISMIC VELOCITY, PERMAFROST DEPTH.

MP 1955
GALVANIC METHODS FOR MAPPING RESISTIVE SEABED FEATURES.
Sellmann, P.V., et al, *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* May 1985, No.85-05, Workshop on Permafrost Geophysics, Golden, Colorado, Oct. 23-24, 1984. Proceedings, p.91-92, ADA-157 485.
Delaney, A.J., Arcone, S.A.
40-1305
SUBSEA PERMAFROST, PERMAFROST PHYSICS, GROUND ICE, CABLES (ROPES), MAPPING, SEA WATER, SALINITY.

MP 1956
HEAT TRANSMISSION WITH STEAM AND HOT WATER.
Aamot, H.W.C., et al, Cogeneration district heating applications. Edited by I. Oliker, New York, American Society of Mechanical Engineers, 1978, p.17-23, Presented at the Winter Annual Meeting of the American Society of Mechanical Engineers, San Francisco, California, December 10-15, 1978. 6 refs.
Phetteplace, G.
40-1267
HEAT TRANSMISSION, WATER PIPES, WATER TEMPERATURE, FLUID FLOW, HEAT FLUX, HEAT LOSS, FLOW RATE, METEOROLOGICAL FACTORS, PRESSURE, COMPUTER APPLICATIONS, DESIGN.

A methodology for design of heat transmission lines is presented. It is based on finding the pipe diameter which yields the lowest total cost. Cost factors considered are cost of energy lost in the form of heat, cost of energy to produce pumping work, and cost of capital to construct the system. The methodology has been developed into a computer code which allows for rapid analysis of alternatives. Results are presented, based on certain assumptions, for various parameters of interest.

MP 1957
THEORY OF NATURAL CONVECTION IN SNOW.
Powers, D., et al, *Journal of geophysical research,* Oct. 20, 1985, 90(D6), p.10,641-10,649, 31 refs.
O'Neill, K., Colbeck, S.C.
40-1224
SNOW PHYSICS, CONVECTION, THERMAL CONDUCTIVITY, HEAT TRANSFER, MASS TRANSFER, PHASE TRANSFORMATIONS, POROUS MATERIALS, WATER VAPOR, LATENT HEAT, MATHEMATICAL MODELS, THEORIES.

Buoyancy-driven flows of air in snow are modeled including the effects of phase change and inclination. Phase change between water vapor and ice is important because of latent heat terms in the energy equation. Upper boundaries of the snow are taken as either permeable or impermeable, with temperature or heat flux specified at the lower boundary. When the ratio of thermal to mass diffusivity is greater than 1, phase change intensifies convection. When this ratio is less than 1, phase change damps convection. The effects of permeable top and uniform heat flux bottom boundary conditions on heat transfer are quantified and described as linear functions of Ra/Ra(cr), where Ra is the Rayleigh number and cr refers to the critical value for the onset of Benard convection. The slope of each function depends only on the thermal boundary condition at the lower boundary. If a snow cover is inclined, Rayleigh convection occurs for any nonzero Rayleigh number. Velocity profiles for flows in inclined layers with permeable tops are derived, and it is found that velocity is proportional to Ra sin phi, where phi is the angle of inclination from the horizontal. The numerical results for different boundary conditions compare reasonably well with experimental results from the literature.

MP 1958
FORWARD-SCATTERING CORRECTED EXTINCTION BY NONSPHERICAL PARTICLES.
Bohren, C.F., et al, *Applied optics,* Apr. 1, 1985, 24(7), p.1023-1029, For another source see 39-2966. 16 refs.
Koh, G.
40-1223
SNOWFLAKES, LIGHT SCATTERING, SNOW CRYSTAL STRUCTURE, PARTICLES, ICE NEEDLES, ANALYSIS (MATHEMATICS).

Measured extinction of light by particles, especially those larger than the wavelength of the light illuminating them, must be corrected for forward-scattered light collected by the detector. Near-forward scattering by arbitrary nonspherical particles is, according to Fraunhofer diffraction theory, more sharply peaked than that by spheres of equal projected area. The difference between scattering by a nonspherical particle and that by an equal-area sphere is greater the more diffusely the particle's projected area is distributed about its centroid. Snowflakes are an example of large atmospheric particles that are often highly nonspherical. Calculations of the forward-scattering correction to extinction by ice needles have been made under the assumption that they can be approximated as randomly oriented prolate spheroids (aspect ratio 10:1). The correction factor can be as much as 20% less than that for equal-area spheres depending on the detector's acceptance angle and the wavelength. Randomly oriented oblate-spheroids scatter more nearly like equal-area spheres.

MP 1959
PEBBLE FABRIC IN AN ICE-RAFTED DIAMICTON.
Domack, E.W., et al, *Journal of geology,* Sep. 1985, 93(5), p.577-591, Refs. p.589-591.
Lawson, D.E.
40-1222
ICE RAFTING, GLACIAL DEPOSITS, SEDIMENTATION, MORAINES, STRATIGRAPHY, FOSSILS, ORIGIN, GLACIER FLOW.

Pebble fabric studies on ice-rafted diamictons have been limited to general observations, with authors noting preferences toward vertical, random, or horizontal orientations. To clarify such observations, pebble fabric data were collected from a fossiliferous diamicton of late Pleistocene age located on Whidbey Island, Washington. The ice-rafted origin of this unit is supported by several independent characteristics including *in situ* macrofauna and microfauna, conformity with subaqueous lithofacies containing dropstones, lower bulk densities and higher void ratios than associated tills, soft sediment deformation structures suggestive of iceberg dumping, textural gradations, and facies relationships. Analysis using the eigenvalue method indicates that ice-rafted fabrics are nearly random with little consistency of vector orientations between sites and without any relationship to the probable direction of glacial flow. The weak fabric is mainly the product of settling through the water column and impact with, or penetration of, the bed. Samples that possess a weak preferred long axis orientation with a low angle of dip, including those from laminated muds, can best be explained by the intermittent effects of bottom currents, a resistant substrate at the time of deposition and post-depositional flowage. Comparisons of pebble fabrics from basal tills, recent sediment flow deposits, and basal, debris-laden ice of an active glacier demonstrate that the ice-rafted fabrics are distinct from those of basal ice and till but are quite similar to those of sediment flow diamictons. Ice-rafted diamictons appear, however, to contain a greater number of elongate stones, with long axis plunge angles exceeding 45 deg, than other glacigenic diamictons.

MP 1960
AUDIBILITY WITHIN AND OUTSIDE DEPOSITED SNOW.
Johnson, J.B., *Journal of glaciology,* 1985, 31(108), p.136-142, 12 refs., In English with French and German summaries.
40-1320
SNOW COVER EFFECT, SNOW ACOUSTICS, SOUND TRANSMISSION, NOISE (SOUND).

Factors which control the audibility within and outside deposited snow are described and applied to explain the preferential detection of sound by persons buried under avalanche debris as compared to persons on the overlying snow surface. Strong attenuation of acoustic waves in snow and the small acoustic impedance differences between snow and air are responsible for the strong absorption and transmission-loss characteristics that are observed for snow. The absorption and transmission-loss characteristics are independent of the direction of propagation of acoustic signals through the snow. The preferential detection of sound by a person buried under snow can be explained by the relatively higher level of background acoustic noise that exists for persons above the snow surface as compared to an avalanche burial victim. This noise masks sound transmitted to persons on the snow surface, causing a reduction of hearing sensitivity as compared to the burial victim. Additionally, the listening concentration of a buried individual is generally greater than for persons working on the snow surface, increasing their subjective awareness of sound. (Auth.)

MP 1961
STATISTICAL RELATIONSHIPS BETWEEN COLD REGIONS SURFACE CONDITIONS AND CLIMATIC PARAMETERS.
Bilello, M.A., Conference on Probability and Statistics in Atmospheric Sciences, 9th, Virginia Beach, VA, Oct. 9-11, 1985. Proceedings, 1985, p.508-517, Reprint from preprint volume.
40-1420
SNOW PHYSICS, ICE PHYSICS, SURFACE PROPERTIES, CLIMATIC FACTORS, ICE COVER THICKNESS, SNOW DENSITY, DEGREE DAYS, FROST.

MP 1962
EMITTANCE: A LITTLE UNDERSTOOD IMAGE DECEPTION IN THERMAL IMAGING APPLICATIONS.
Munis, R.H., et al, *Society of Photo-Optical Instrumentation Engineers. Proceedings,* Apr. 1985, Vol.549, p.72-78, 6 refs.
Marshall, S.J.
40-1423
THERMAL RADIATION, THERMAL PROPERTIES, MATERIALS, RADIOMETRY, TEMPERATURE MEASUREMENT.

Image contrast enhancement sometimes complicates image understanding. A scene that consists of slightly dissimilar target and background emittances may not be readily identifiable without image enhancement. Even if the emittance differential can be sharply contrasted, those image surface patterns that convey subsurface thermal information may not be visible because of the wide dynamic range that must be accommodated by the thermal imaging system. This paper describes how emittance complicates the interpretation of thermal images. High and low emittance values affect the logic required for understanding thermal scenes. Thermal scenes containing emittance differentials are easier to interpret if there is a large contrast between the object and the background.

MP 1963
THERMAL EMISSIVITY OF DIATHERMANOUS MATERIALS.
Munis, R.H., et al, *Optical engineering,* Sep.-Oct. 1985, 24(5), p.872-878, 10 refs.
Marshall, S.J.
40-1422
RADIOMETRY, OPTICAL PROPERTIES, INFRARED PHOTOGRAPHY, TEMPERATURE MEASUREMENT, ABSORPTION, MATERIALS.

Thermal (2.0 to 5.6 micron) measurements of the normal emissivity of several diathermanous materials having slightly different refractive indices were made at 15.2 C, 4.9 C, and -5.6 C. Calculations of the total hemispherical emissivity were made from normal emissivity and plotted against the optical depth. A comparison of these data with a model proposed by R. Gardon [J. Am. Ceram. Soc. 39(8), 278 (1956)] indicates that at near-ambient temperatures they agree very closely. This comparison presumes that the narrow range of refractive indices about n=1.5 associated with these specimens would not preclude them from being treated as having a value of 1.5.

MP 1964
STRATEGIES FOR WINTER MAINTENANCE OF PAVEMENTS AND ROADWAYS.
Minsk, L.D., et al, *New York Academy of Sciences. Annals,* 1984, Vol.431, p.155-167, 14 refs.
Eaton, R.A.
40-1427
WINTER MAINTENANCE, ROAD MAINTENANCE, SNOW REMOVAL, ICE REMOVAL, PAVEMENTS, FREEZE THAW CYCLES, CLIMATIC FACTORS, SNOW DEPTH, COST ANALYSIS.

MP 1965
STRUCTURE, SALINITY AND DENSITY OF MULTI-YEAR SEA ICE PRESSURE RIDGES.
Richter-Menge, J.A., et al, *Journal of energy resources technology,* Dec. 1985, 107(4), p.493-497, For another source and abstract see 39-2413 (MP 1857). 11 refs.
Cox, G.F.N.
40-1444
PRESSURE RIDGES, ICE STRUCTURE, ICE SALINITY, ICE DENSITY, ICE PHYSICS, ICE LOADS, SEA ICE, BEAUFORT SEA.

MP 1966
IN-ICE CALIBRATION TESTS FOR AN ELONGATE, UNIAXIAL BRASS ICE STRESS SENSOR.
Johnson, J.B., *Journal of energy resources technology,* Dec. 1985, 107(4), p.506-510, For another source and abstract see 39-2420 (MP 1859). 8 refs.
40-1446
ICE COVER STRENGTH, ICE SOLID INTERFACE, ICE LOADS, STRESSES, MEASURING INSTRUMENTS, TESTS.

MP 1967
EXPERIMENTAL MEASUREMENT OF CHANNELING OF FLOW IN POROUS MEDIA.
Oliphant, J.L., et al, *Soil science,* May 1985, 139(5), p.394-399, 10 refs.
Tice, A.R.
40-1481
SOIL WATER, WATER FLOW, POROUS MATERIALS, CHANNELS (WATERWAYS), HYDRAULICS, VISCOUS FLOW, LAMINAR FLOW, DIFFUSION.

By comparing experimental measurements of the hydraulic conductivity and the effective self-diffusivity of water in porous media, a channeling parameter, c, is defined. This parameter measures the degree of division of flow paths in the media, but does not depend on the tortuosity of the paths or surface effects on the viscosity of the water. Values of c are obtained for Na-saturated montmorillonites containing from 0.82 to 7.7 g of water per g of clay and for Fairbanks silt containing from 0.135 to 0.23 g of water per g of silt. Values for the montmorillonites remain relatively close to the theoretically predicted value of 1/3 at all water contents, indicating maximally divided flow paths. Values for the silt vary from 100 to over 2000, indicating highly channeled flow.

MP 1968
SOME RECENT DEVELOPMENTS IN VIBRATING WIRE ROCK MECHANICS INSTRUMENTATION.
Dutta, P.K., 1985, 12p., 20 refs. Presented at the 26th U.S. Symposium on Rock Mechanics, Rapid City, SD, June 26-28, 1985.
40-1490
ROCK MECHANICS, COLD WEATHER OPERATION, MEASURING INSTRUMENTS, VIBRATION, STRESSES, MODELS, ACCURACY.

MP 1969
BRITTLENESS OF REINFORCED CONCRETE STRUCTURES UNDER ARCTIC CONDITIONS.
Kivekäs, L., et al, *Finland. Technical Research Centre. Research reports,* 1985, No.369, 28 + 14p., In Finnish with English summary. 9 refs.
Korhonen, C.
40-1492
WINTER CONCRETING, CONCRETE STRUCTURES, LOADS (FORCES), REINFORCED CONCRETES, CONCRETE STRENGTH, BRITTLENESS, FRACTURING, IMPACT STRENGTH, TEMPERATURE EFFECTS.

When plain reinforcing bars are tested under impact load according to the steel standards their failure becomes brittle already at the arctic temperature region. However, when reinforced concrete structures are loaded with an impact load, the reinforcing bars are subjected to loading conditions very different from the test with the plain rebars, and this has a significant effect on the transition temperature.

MP 1970
ION AND MOISTURE MIGRATION AND FROST HEAVE IN FREEZING MORIN CLAY.
Qiu, G., et al, *Journal of glaciology and geocryology,* Mar. 1986, 8(1), p.1014, 9 refs., In Chinese with English summary.
Chamberlain, E.J., Iskandar, I.K.
40-4634
FROST HEAVE, SOIL WATER MIGRATION, IONS, CLAY SOILS, SOIL CHEMISTRY, WATER CONTENT, FREEZING RATE, TESTS.

Sixteen specimens made of Morin Clay with a saturation percentage of 86% were subjected to freezing tests in open system fed by distilled water, NaCl solution, CaCl(2) solution and Na(2)SO(4) solution respectively. Before freezing test, specimens were homogeneous in water content but heterogeneous in chemical composition with a vertical concentration gradient. After freezing test, both water content and the dominant-anion content in frozen part of the soil samples increase; this means that not only moisture but also ions were migrating toward the freezing zone during tests.

MP 1971
TENSILE STRENGTH OF FROZEN SILT.
Zhu, Y., , *Journal of glaciology and geocryology,* Mar. 1986, 8(1), p.15-28, 9 refs., In Chinese with English summary.
Carbee, D.L.
40-4635
FROZEN GROUND STRENGTH, TENSILE PROPERTIES, STRAIN TESTS, SEDIMENTS, SOIL COMPACTION, DENSITY (MASS/VOLUME), TEMPERATURE EFFECTS.

Constant strain-rate tension tests were conducted on remolded saturated frozen Fairbanks silt at various temperatures, strain rates and densities. It is found that the critical strain rate of the ductile-brittle transition does not depend upon temperature, but varies with density. It has a value of 0.01/s for the silt with medium density and 0.0005/s for low density. The peak tensile strength considerably decreases with decreasing strain rate for ductile failure, while it slightly decreases with increasing strain rate for brittle fracture. The failure strain remains almost the same for temperatures lower than about -2C, but it varies with density and strain rate. The initial tangent modulus is found not to depend upon strain rate, but increases with decreasing temperature and density.

MP 1972
ICE BLOCK STABILITY.
Daly, S.F., Water for resource development, Proceedings of the ASCE Hydraulics Division Specialty Conference, edited by D.L. Schreiber, New York, American Society of Civil Engineers, 1984, p.544-548, 5 refs.
40-1548
RIVER ICE, ICE FLOES, ICE PRESSURE.

In this paper a simple formulation of the forces acting on an ice block in contact with an intact ice cover is presented. Underturning of the ice block is the assumed mechanism by which the block is swept under the ice cover. The data can be divided into two separate cases, a shallow water case and a deep water case. The conditions of instability for each case are determined empirically. The resultant prediction of the velocity at which the block is swept under the cover reproduces the data very well over the entire range of nondimensional ice block thicknesses. The "no-spill" condition used in earlier formulations is not required.

MP 1973
MATHEMATICAL MODELING OF RIVER ICE PROCESSES.
Shen, H.T., Water for resource development, Proceedings of the ASCE Hydraulics Division Specialty Conference, edited by D.L. Schreiber, New York, American Society of Civil Engineers, 1984, p.554-558, 16 refs.
40-1550
RIVER ICE, ICE FORMATION, ICE BREAKUP, ANALYSIS (MATHEMATICS).

Computer modeling of flow and ice conditions in a river is an important element in the planning of water resources projects in northern regions. In this paper, a brief review on the present knowledge of formulating river ice process is given.

MP 1974
MITIGATIVE AND REMEDIAL MEASURES FOR CHILLED PIPELINES IN DISCONTINUOUS PERMAFROST.
Sayles, F.H., Seminar on Pipelines and Frost Heave, Caen, Apr. 25-27, 1984. Proceedings. English version. Edited by S.R. Dallimore and P.J. Williams. Ottawa, Carleton University, July 1984, p.61-62.
39-3049
DISCONTINUOUS PERMAFROST, FROST HEAVE, UNDERGROUND PIPELINES, SHEAR PROPERTIES, FROST ACTION, PERMAFROST BENEATH ROADS, FROST PENETRATION, DAMAGE, DESIGN CRITERIA.

MP 1975
USING LANDSAT DATA FOR SNOW COVER/VEGETATION MAPPING.
Merry, C.J., et al, Annual Department of Defense Mapping, Charting, and Geodesy Conference, 9th, 1984. Report, Washington, D.C., Defense Mapping Agency, [1984], p.II(140)-II(144), 7 refs.
McKim, H.L.
40-1535
SNOW COVER DISTRIBUTION, REMOTE SENSING, VEGETATION, LANDSAT, MAPPING, SNOW DEPTH, SNOW WATER EQUIVALENT.

MP 1976
HEATING ENCLOSED WASTEWATER TREATMENT FACILITIES WITH HEAT PUMPS.
Martel, C.J., et al, Hanover, NH, U.S.A. CRREL, [1982], 20p., Presented at the Symposium on Utilities Delivery in Cold Regions, Edmonton, Alberta, May 25-26, 1982. Unpublished manuscript. 13 refs.
Phetteplace, G.E.
40-1684
WASTE TREATMENT, WATER TREATMENT, UNDERGROUND FACILITIES, UNDERGROUND PIPELINES, HEATING.

MP 1977
COMPARATIVE FIELD TESTING OF BURIED UTILITY LOCATORS.
Bigl, S.R., et al, Hanover, NH, U.S.A. CRREL, [1984], 25p., Presented at the APWA Public Works Conference and Equipment Show, Edmonton, Alberta, May 13-15, 1984. Unpublished manuscript. 1 ref.
Phetteplace, G.E., Henry, K.S.
40-1683
UNDERGROUND FACILITIES, UTILITIES, MAGNETIC SURVEYS, MAINTENANCE, DETECTION, DAMAGE, TESTS, RADAR ECHOES.

Locating buried utilities for repair, servicing or prevention of damage is often necessary when excavation is to be conducted in a particular area. The most widely used methods for detection of buried facilities are magnetic induction, magnetometry, and radiofrequency tracking. Downward-looking radar units designed specifically for utility location are in the development stages. Comparative field tests of eight locators were conducted at West Point and Newburgh, New York, over various types of buried utilities including iron and steel pipe, cable, vitreous tile pipe and plastic pipe.

MP 1978
HEAT RECOVERY FROM PRIMARY EFFLUENT USING HEAT PUMPS.
Phetteplace, G.E., et al, CLIMA 2000 Conference, Copenhagen, Aug. 1985. Proceedings, Vol.6, [1985], p.199-203, 1 ref.
Ueda, H.T., Martel, C.J.
40-1682
HEAT RECOVERY, WASTE TREATMENT, WATER TREATMENT, SEWAGE, HEATING.

MP 1979
SIMPLIFIED DESIGN PROCEDURES FOR HEAT TRANSMISSION SYSTEM PIPING.
Phetteplace, G.E., CLIMA 2000 Conference, Copenhagen, Aug. 1985. Proceeding, Vol.6, [1985], p.451-456, 5 refs.
40-1686
HEAT TRANSMISSION, UNDERGROUND PIPELINES, WATER PIPELINES, HEAT LOSS, DESIGN, COST ANALYSIS, ANALYSIS (MATHEMATICS).

MP 1980
ANALYSIS OF HEAT LOSSES FROM THE CENTRAL HEAT DISTRIBUTION SYSTEM AT FORT WAINWRIGHT.
Phetteplace, G.E., [1982], 20p., Unpublished manuscript; presented at the Symposium on Utilities Delivery in Cold Regions, Edmonton, Alberta, May 25-26, 1982. 5 refs.
40-1660
HEAT TRANSMISSION, HEAT LOSS, HEATING, HEAT SOURCES, DEGREE DAYS, TEMPERATURE EFFECTS, ANALYSIS (MATHEMATICS), UNITED STATES—ALASKA—FAIRBANKS.

MP 1981
AIRBORNE-SNOW CONCENTRATION MEASURING EQUIPMENT.
Lacombe, J., *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* June 1982, 82-17, Snow Symposium, 1st, Hanover, NH, Aug. 1981. Proceedings, p.17-46, ADB-091 442, 12 refs.
40-1929
SNOWFALL, SNOWFLAKES, FALLING BODIES, MEASURING INSTRUMENTS, VISIBILITY, AIRBORNE EQUIPMENT, ACCURACY, TRANSMISSION.

A brief introduction to the function of the Airborne-Snow Concentration Measuring Equipment (ASCME) and its usefulness for characterizing the winter environment is given. The deficiencies of alternative systems are identified. ASCME hardware and basic system operation are described in detail. The governing design equation and choice of design parameters are discussed, along with estimates of system accuracy. Evidence of ASCME's satisfactory performance during its inaugural operation at SNOW-ONE is presented and design improvements to be incorporated and used during SNOW ONE-A are mentioned. Snowfall rate and airborne-snow concentration data are also compared, showing a weak correlation between the two parameters at low concentration levels.

MP 1982
SNOW AND FOG PARTICLE SIZE MEASUREMENTS.
Berger, R.H., *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* June 1982, 82-17, Snow Symposium, 1st, Hanover, NH, Aug. 1981. Proceedings, p.47-58, ADB-091 442, 6 refs.
40-1930
SNOWFLAKES, FOG, PARTICLE SIZE DISTRIBUTION, ELECTROMAGNETIC PROSPECTING, TRANSMISSION, SNOW CRYSTAL STRUCTURE, LIGHT SCATTERING, INFRARED RADIATION, FALLING BODIES, DATA PROCESSING.

During the SNOW-ONE field measurements Knollenberg 2-D grey imaging probes were used to characterize airborne snow. This application of the probes presents problems due to the shape and orientation of the snow particles. The techniques used to surmount these problems are described. Results are presented in a comparison between the total snowflake area concentration and the transmittance in the visible and infrared.

MP 1983
METEOROLOGY AND OBSERVED SNOW CRYSTAL TYPES DURING THE SNOW-ONE EXPERIMENT.
Bilello, M.A., *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* June 1982, 82-17, Snow Symposium, 1st, Hanover, NH, Aug. 1981. Proceedings, p.59-75, ADB-091 442, 8 refs.
40-1931
SNOW CRYSTAL STRUCTURE, SNOWFALL, METEOROLOGICAL FACTORS, SNOWFLAKES, FALLING BODIES, ELECTRICAL MEASUREMENT, OPTICAL PROPERTIES, SNOWSTORMS.

A survey of the surface pressure systems, weather fronts, and air masses that influenced northern Vermont during the periods of snowfall in January and February 1981 was conducted. Vertical profiles of the temperature and moisture, and observations of the falling snow crystals made at the SNOW-ONE site were also retrieved for the same time period. This information was used to conduct a study on associations between meteorological conditions and observed snow crystal characteristics. Examples of the results obtained from the various snowfall events that occurred during the field test period are presented. This study was conducted with the ultimate objective of associating large-scale weather patterns with the on-site frozen particle characterization measurements, and the data obtained concurrently by the electro-optical sensor systems.

MP 1984
METEOROLOGICAL MEASUREMENTS AT CAMP ETHAN ALLEN TRAINING CENTER, VERMONT.
Bates, R., *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* June 1982, 82-17, Snow Symposium, 1st, Hanover, NH, Aug. 1981. Proceedings, p.77-112, ADB-091 442, 4 refs.
40-1932
METEOROLOGICAL INSTRUMENTS, SNOWFALL, PRECIPITATION GAGES, AIR TEMPERATURE, SNOWSTORMS, DEW POINT, HUMIDITY, WIND VELOCITY, WIND DIRECTION, SNOW WATER EQUIVALENT, VISIBILITY, SNOW DEPTH.

This paper contains a detailed description of the meteorological instruments used by CRREL at SNOW-ONE, together with information on their performance and reliability. Some of the data collected are discussed and analyzed. Redfield (1981) presented a substantial amount of the meteorological data obtained by CRREL during SNOW-ONE, including the hourly summaries of observations recorded by a meteorological team fron the Atmospheric Sciences Laboratory (ASL), Maynard, Massachusetts.

MP 1985
GEOMETRY AND PERMITTIVITY OF SNOW.
Colbeck, S.C., *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* June 1982, 82-17, Snow Symposium, 1st, Hanover, NH, Aug. 1981. Proceedings, p.113-131, ADB-091 442, 37 refs.
40-1933
SNOW PHYSICS, ELECTROMAGNETIC PROPERTIES, SNOW ELECTRICAL PROPERTIES, SNOW CRYSTAL STRUCTURE, POROSITY, SNOW WATER CONTENT, UNFROZEN WATER CONTENT.

The geometry and porosity of dry snow varies widely depending on the history of conditions. The permittivity of dry snow increases with increasing ice content but is not greatly affected by the shapes of the ice particles. In wet snow the permittivity increases with liquid content and the geometry is very important. However, the liquid-like layer has little effect on permittivity. The permittivity is described using Polder and van Santeen's mixing formulae and approximations of the geometries at high and low liquid contents. It is shown that the common assumption of liquid shells over ice spheres is both physically incorrect and leads to large errors.

MP 1986
SNOW CALORIMETRIC MEASUREMENT AT SNOW-ONE.
Fisk, D., *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* June 1982, 82-17, Snow Symposium, 1st, Hanover, NH, Aug. 1981. Proceedings, p.133-138, ADB-091 442.
40-1934
SNOW THERMAL PROPERTIES, SNOW WATER CONTENT, UNFROZEN WATER CONTENT, CALORIMETERS, TEMPERATURE MEASUREMENT, SNOW MELTING, FREEZING, ACCURACY, TESTS.

Free water content of fallen snow was measured near the surface and with depth during the SNOW-ONE Field Experiment using both freezing and melting calorimetric methods. The principles and procedures of each method are described. Test data are presented, possible sources of error are examined, and the problems and relative merits of each method are discussed. Subsequent work and future plans are described.

MP 1987
PROBLEMS IN SNOW COVER CHARACTERIZATION.
O'Brien, H.W., *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* June 1982, 82-17, Snow Symposium, 1st, Hanover, NH, Aug. 1981. Proceedings, p.139-147, ADB-091 442, 5 refs.
40-1935
SNOW OPTICS, SNOW PHYSICS, INFRARED SPECTROSCOPY, LIGHT TRANSMISSION, UNFROZEN WATER CONTENT, GRAIN SIZE, MILITARY OPERATION, REFLECTIVITY, WAVE PROPAGATION, SNOW COVER, SNOW DENSITY, SNOWFLAKES.

Comparison of spectral reflectance measurements of snow cover with theoretical predictions based on hypothetical snow grain size indicate that the appropriate dimensions for commensuration may be illusive indeed. Measurements of near-infrared reflectance of snow covers *in situ* are presented in illustration and some potential ramifications inferred.

MP 1988
ACOUSTIC AND PRESSUREMETER METHODS FOR INVESTIGATION OF THE RHEOLOGICAL PROPERTIES OF ICE.
Fish, A.M., Hanover, NH, USA CRREL, 1978, 196p., *Ph.D. thesis. Refs. p.181-196.*
40-1843
ICE CREEP, RHEOLOGY, ICE STRENGTH, ACOUSTIC MEASUREMENT, CRACKING (FRACTURING), COMPRESSIVE PROPERTIES, PRESSURE, ICE CRYSTAL STRUCTURE, ICE MECHANICS, TIME FACTOR, MEASURING INSTRUMENTS, SETTLEMENT (STRUCTURAL).

Theoretical and experiment studies of time-dependent deformation and failure of columnar-grained ice are presented. Laboratory uniaxial compression tests at constant and steadily increasing stresses were accompanied by simultaneous recording of acoustic emissions. Strength criteria and constitutive equations were established, describing grain disintegration, microcrack initiation and acoustic emission dynamics during creep, and their relationship to the rheological properties of ice. The rheological properties of ice were studied under laboratory and field conditions using a pressuremeter, leading to the development of an *in situ* method for determining the mechanical properties of ice taking into account the time factor. The results of the studies were applied in analyses of settlements of foundations on high-ice-content soils and ground ice. Based on the comparison of experimental data with calculated settlements, it is shown that the characteristics of ice used in the analysis can be determined either from laboratory tests or *in situ*, by means of a pressuremeter.

MP 1989
VIBRATION ANALYSIS OF THE YAMACHICHE LIGHTPIER.
Haynes, F.D., International Modal Analysis Conference, 4th, Los Angeles, CA, Feb. 3-6, 1986, Proceedings. Vol.1, Schenectady, N.Y., Union College, 1986, p.238-241, 11 refs.
40-1881
PIERS, VIBRATION, ICE LOADS, SHEAR STRENGTH, MATHEMATICAL MODELS, COMPUTER APPLICATIONS.

To determine its dynamic characteristics, the Yamachiche lightpier located in Lac St. Pierre, Quebec, was instrumented with geophones, accelerometers, and an inclinometer. Fifteen breakable bolts with failure strengths from 45,000 to 450,000 N were used to apply a step unloading force on the pier. The damping and stiffness were obtained from the data in the time domain. The natural frequencies and mode shapes were obtained from the data transformed into the frequency domain. A modal analysis computer program was used to verify the natural frequencies and mode shapes. A mathematical model was developed that includes translation, rotation, and shear beam deformation of the pier.

MP 1990
SOIL FREEZING RESPONSE: INFLUENCE OF TEST CONDITIONS.
McCabe, E.Y., et al, *Geotechnical testing journal*, June 1985, 8(2), p.49-58, 22 refs.
Kettle, R.J.
40-1900
SOIL FREEZING, FROST HEAVE, SOIL COMPACTION, FROST RESISTANCE, SOIL PRESSURE, TEMPERATURE GRADIENTS, TESTS.

The response of soils to freezing has been assessed in terms of frost heave, and the heaving pressure developed when the specimen is restrained. As both techniques have been suggested for assessing frost susceptibility, it was considered essential to determine the influence of the test conditions on the soil response. This investigation was concerned with specimen preparation, specimen size, and freezing procedure. The test material consisted of an artificially produced matrix, into which controlled amounts of coarse aggregate could be blended. This reduced the likelihood of variation in the results because of random changes in the test materials. The results clearly demonstrated the sensitivity of both heave and heaving pressure to the test conditions. When modified or new test methods are being formulated, it is essential to consider the influence of such factors, particularly when making comparisons between different testing techniques. Such modifications may also require changes in the particular criteria used to assess frost susceptibility.

MP 1991
FIELD OBSERVATIONS OF ELECTROMAGNETIC PULSE PROPAGATION IN DIELECTRIC SLABS.
Arcone, S.A., *Geophysics*, Oct. 1984, 49(10), p.1763-1773, 15 refs.
40-1959
ELECTROMAGNETIC PROPERTIES, ICE COVER EFFECT, WAVE PROPAGATION, DIELECTRIC PROPERTIES, ICE SHEETS, PROFILES, VELOCITY, REFLECTION, REFRACTION.

The propagation of electromagnetic pulses in naturally occurring dielectric surface layers has been examined. Pulse duration used in field experiments reported here has been on the order of nanoseconds with pulse bandwidths in the high VHF to low UHF band. The layers were sheets of fresh water ice and granite at thicknesses ranging between .4 and 4 m. Both transverse electric (TE) and transverse magnetic (TM) modes were attempted but only the TE propagation could be interpreted. Analog recordings of wide-angle reflection and refraction (WARR) profiles were taken and recorded in a continuous graphic display. The displays allowed easy identification of phase fronts thereby facilitating study of the dispersion of the pulses. The phase and group velocities of the wave-group packets agree well with the velocities predicted from dispersion curves derived from the modal waveguide equation. In one case the Airy phase of wave-packet propagation occurred. The best measure of the dielectric constant of the layer was the frequency of the air wave.

MP 1992
SHOPPER'S GUIDE TO ICE PENETRATION.
Mellor, M., *U.S. Army Cold Regions Research and Engineering Laboratory. Special report*, Dec. 1984, SR 84-33, Workshop on Penetration Technology, Hanover, NH, June 12-13, 1984. Proceedings, p.1-35, ADB-093880, 11 refs.
40-1962
ICE DRILLS, ICE COVER THICKNESS, PENETRATION, ICE COVER STRENGTH, ROTARY DRILLS, PROJECTILE PENETRATION, HYDRAULIC JETS, PERCUSSION DRILLS, LASERS, THERMAL DRILLS, EXPLOSION EFFECTS, ANALYSIS (MATHEMATICS), ICE BLASTING.

MP 1993
SEA ICE CHARACTERISTICS AND ICE PENETRATION PROBABILITIES IN THE ARCTIC OCEAN.
Weeks, W.F., *U.S. Army Cold Regions Research and Engineering Laboratory. Special report*, Dec. 1984, SR 84-33, Workshop on Penetration Technology, Hanover, NH, June 12-13, 1984. Proceedings, p.37-65, ADB-093880, 21 refs.
40-1963
SEA ICE DISTRIBUTION, PENETRATION, PACK ICE, DRIFT, ICE COVER THICKNESS, ICE CRYSTAL STRUCTURE, ICE SALINITY, ICE TEMPERATURE, ICE DEFORMATION, ARCTIC OCEAN.

MP 1994
MODELING OF ARCTIC SEA ICE CHARACTERISTICS RELEVANT TO NAVAL OPERATIONS.
Hibler, W.D., III, et al, *U.S. Army Cold Regions Research and Engineering Laboratory. Special report*, Dec. 1984, SR 84-33, Workshop on Penetration Technology, Hanover, NH, June 12-13, 1984. Proceedings, p.67-91, ADB-093880, 21 refs.
Weeks, W.F.
40-1964
ICE NAVIGATION, SEA ICE DISTRIBUTION, ICE MECHANICS, DRIFT, ICE COVER THICKNESS, SURFACE ROUGHNESS, ICE SURFACE, ICE ELECTRICAL PROPERTIES, ICE LOADS, ICE STRENGTH, MODELS, RHEOLOGY, VELOCITY.

MP 1995
PENETRATION OF SHAPED CHARGES INTO ICE.
Mellor, M., *U.S. Army Cold Regions Research and Engineering Laboratory. Special report*, Dec. 1984, SR 84-33, Workshop on Penetration Technology, Hanover, NH, June 12-13, 1984. Proceedings, p.137-148, ADB-093 880, 7 refs.
40-1969
ICE COVER STRENGTH, MILITARY OPERATION, PENETRATION TESTS, EXPLOSIVES, ICE DEFORMATION.

Shaped charges fired from air into ice give holes of typical form for cohesive solids. There are only a few reported results from test shots in ice, but supplementary data can be obtained by adjusting the results from tests in ice-bonded soil in accordance with target density. Present indications are that charges with narrow angle cones (appr. 45 deg) can penetrate about 16 cone diameters, giving a hole diameter near mid-depth of about 1/3 of the cone diameter. Charges with wide-angle cones (60-90 deg) might penetrate about 12 cone diameters, giving a hole diameter near mid-depth of about 2/3 cone diameters. Optimum standoff in air seems to be around 4 cone diameters. So far, we have no data for shaped charges fired into ice under water.

MP 1996
ICE PENETRATION TESTS.
Garcia, N.B., et al, *U.S. Army Cold Regions Research and Engineering Laboratory. Special report*, Dec. 1984, SR 84-33, Workshop on Penetration Technology, Hanover, NH, June 12-13, 1984. Proceedings, p.209-240, ADB-093 880, 6 refs.
Farrell, D., Mellor, M.
40-1974
PENETRATION TESTS, ICE STRENGTH, GRAIN SIZE, FLEXURAL STRENGTH, BRITTLENESS, IMPACT STRENGTH, VELOCITY, ICE DENSITY, PROJECTILE PENETRATION, ICE TEMPERATURE.

MP 1997
MECHANICS OF ICE COVER BREAKTHROUGH.
Kerr, A.D., *U.S. Army Cold Regions Research and Engineering Laboratory. Special report*, Dec. 1984, SR 84-33, Workshop on Penetration Technology, Hanover, NH, June 12-13, 1984. Proceedings, p.245-262, ADB-093 880, 12 refs.
40-1975
ICE COVER STRENGTH, ICE BREAKING, PENETRATION TESTS, IMPACT STRENGTH, LOADS (FORCES), FLOATING ICE, BEARING STRENGTH, TIME FACTOR, MILITARY OPERATION, ANALYSIS (MATHEMATICS).

MP 1998
SURFACING SUBMARINES THROUGH ICE.
Assur, A., *U.S. Army Cold Regions Research and Engineering Laboratory. Special report*, Dec. 1984, SR 84-33, Workshop on Penetration Technology, Hanover, NH, June 12-13, 1984. Proceedings, p.309-318, ADB-093 880, 8 refs.
40-1978
SUBMARINES, ICE COVER EFFECT, PENETRATION, ICE MECHANICS, ICE BREAKING, STRESSES, STRAINS, SEA ICE, ANALYSIS (MATHEMATICS), LOADS (FORCES).

MP 1999
ICE DRILLING AND CORING SYSTEMS—A RETROSPECTIVE VIEW.
Sellmann, P.V., et al, *U.S. Army Cold Regions Research and Engineering Laboratory. Special report*, Dec. 1984, SR 84-33, Workshop on Penetration Technology, Hanover, NH, June 12-13, 1984. Proceedings, p.125-127, ADB-093 880.
Rand, J.H.
40-1966
ICE CORES, ICE DRILLS, ICE CORING DRILLS, EQUIPMENT, PENETRATION.

MP 2000
TECHNIQUES FOR MEASUREMENT OF SNOW AND ICE ON FRESHWATER.
Adams, W.P., et al, International Northern Research Basins Workshop/Symposium, 6th, Jan. 26-30, 1986. Proceedings, Vol.2, Houghton, Michigan Technological University, ⌈1986⌉, p.174-222, Refs. p.219-222.
Prowse, T.D., Bilello, M.A.
40-2138
ICE SURVEYS, SNOW SURVEYS, FLOATING ICE, LAKE ICE, RIVER ICE, ICE VOLUME, MEASUREMENT, FREEZEUP, ICE BREAKUP, ICE MECHANICS.

Information on routine snow and ice survey programs in Finland, Iceland, Norway, Sweden, Canada and the United States is juxtaposed in this paper. Standard methods of ice and snow measurement and practical alternative methods are described with information on reporting procedures and data storage. In each case, points of contact are provided for those seeking data on floating snow and ice. The purpose of the paper is to improve the flow of information between those responsible for winter lake and river programs in circumpolar countries.

MP 2001
MODELING SEA-ICE DYNAMICS.
Hibler, W.D., III, *Advances in geophysics*, 1985, Vol.28, Issues in atmospheric and oceanic modeling. Pt. A: Climate dynamics. Edited by S. Manabe, p.549-579, 44 refs.
40-2217
ICE MECHANICS, SEA ICE DISTRIBUTION, ICE MODELS, DRIFT, ICE COVER THICKNESS, ICE COVER STRENGTH, FREEZE THAW CYCLES, RHEOLOGY, PLASTIC FLOW, ICE WATER INTERFACE, AIR WATER INTERACTIONS, SEASONAL VARIATIONS.

MP 2002
SURVEY OF AIRPORT PAVEMENT DISTRESS IN COLD REGIONS.
Vinson, T.S., et al, International Conference on Cold Regions Engineering, 4th, Anchorage, Alaska, Feb. 24-26, 1986. Proceedings. Edited by W.L. Ryan, New York, American Society of Civil Engineers, 1986, p.41-50, 5 refs.
Zomerman, I., Berg, R., Tomita, H.
40-2429
AIRPORTS, PAVEMENTS, FREEZE THAW CYCLES, CRACKING (FRACTURING), DAMAGE, CLIMATIC FACTORS, DESIGN.

In early fall 1984, USACRREL conducted a study of airport pavements in cold regions of the United States. The most common pavement problems were associated with non-traffic related phenomena and include (1) pre-existing cracks reflecting through asphalt concrete overlays (in two years or less), (2) thermal cracking, and (3) longitudinal cracking (at a construction joint). Most of the airports experienced (1) water pumping up through cracks and joints in the pavements during spring thaw, or (2) additional roughness due to differential frost heave in the winter, or both problems. Many airport managers reported that debris was generated at cracks during the winter and spring. Several airports experienced problems with lighting in the winter and spring. Many pavement problems can be traced to the evolutionary history of general aviation airports and the lack of consideration for site drainage.

MP 2003
LESSONS LEARNED FROM EXAMINATION OF MEMBRANE ROOFS IN ALASKA.
Tobiasson, W., et al, International Conference on Cold Regions Engineering, 4th, Anchorage, Alaska, Feb. 24-26, 1986. Proceedings. Edited by W.L. Ryan, New York, American Society of Civil Engineers, 1986, p.277-290, 10 refs.
Osgood, S.
40-2449
ROOFS, MOISTURE DETECTION, FREEZE THAW CYCLES, DAMAGE, THERMAL EXPANSION, THERMAL EFFECTS.

During 1984 and 1985 airborne infrared roof moisture surveys were conducted of membrane roofs at army installations in Alaska. Many of these roofs were also visually inspected and cored to verify infrared findings. Numerous areas of wet insulation were found but often they were small enough and the surrounding roofing system was in good enough condition to warrant removal and replacement of just the wet areas. Essentially all moisture entered from the exterior through flaws in the membrane and flashings. The lack of problems from internal moisture indicates that current vapor retarders, even though imperfect, are adequate. Some "cold regions" appurtenances such as membrane control joints, and insulation breather vents appear to do more harm than good. The protected membrane (upside-down) roofing system is well suited to Alaska but some problems have occurred when the membrane lacks slope to drain. Low-strength concrete pavers used for roof ballast have been deteriorated by freeze-thaw action.

MP 2004

ICE COVER RESEARCH—PRESENT STATE AND FUTURE NEEDS.

Kerr, A.D., et al, International Conference on Cold Regions Engineering, 4th, Anchorage, Alaska, Feb. 24-26, 1986. Proceedings. Edited by W.L. Ryan, New York, American Society of Civil Engineers, 1986, p.384-399, Refs. p.392-399.

Frankenstein, G.E.

40-2458

ICE COVER STRENGTH, FLOATING ICE, ICE LOADS, ICE PRESSURE, OFFSHORE STRUCTURES, DYNAMIC LOADS, BEARING STRENGTH, ENGINEERING, ICE COVER THICKNESS, STRESSES.

Presentation reviews, at first, a number of problem areas in ice engineering, such as the determination of vertical and horizontal forces floating ice covers exert on fixed structures, the bearing capacity of ice covers subjected to loads of short or long duration, and the response of ice covers subjected to moving loads. The analytical fundamentals are then briefly reviewed and their relationship to actual field conditions is discussed. The presentation concludes with a discussion of problems encountered in laboratory tests. Throughout the presentation areas that require further study and clarification are indicated.

MP 2005

UPPER DELAWARE RIVER ICE CONTROL—A CASE STUDY.

Zufelt, J.E., et al, International Conference on Cold Regions Engineering, 4th, Anchorage, Alaska, Feb. 24-26, 1986. Proceedings. Edited by W.L. Ryan, New York, American Society of Civil Engineers, 1986, p.760-770, 7 refs.

Doe, W.W., III.

40-2487

ICE CONTROL, RIVER ICE, ICE JAMS, ICE CONDITIONS, ICE BOOMS, DRIFT, ICE MECHANICS, FLOODING, COUNTERMEASURES.

The upper one-third of the Delaware River is characterized by a steep gradient with a general riffle/pool sequence. Due to seasonal low flows, a considerable volume of ice is generated and transported throughout the winter months. During February 1981 a catastrophic breakup ice jam occurred along a reach of the Delaware River near Port Jervis, NY, causing $14.5 million in damages. In February 1982 another breakup ice jam occurred at the same location, causing much concern but minimal flooding and damages. These events prompted the Philadelphia District, U.S. Army Corps of Engineers, to conduct an investigation of the Upper Delaware River to determine if some form of ice control structure could be implemented in order to reduce ice jam-induced flooding. This paper focuses on the field investigations and analyses performed by the U.S. Army Cold Regions Research and Engineering Laboratory for the Philadelphia District during the period 1983-1985. The study included both on site and remote monitoring of ice conditions and hydraulic analysis of several ice control structure alternatives.

MP 2006

EXPERIMENTS ON THERMAL CONVECTION IN SNOW.

Powers, D., et al, *Annals of glaciology,* 1985, Vol.6, Symposium on Snow and Ice Processes at the Earth's Surface, Sapporo, Japan, Sep. 2-7, 1984. Proceedings, p.43-47, 16 refs.

Colbeck, S.C., O'Neill, K.

40-2306

SNOW PHYSICS, CONVECTION, HEAT TRANSFER.

Thermal convection is observed in snow and in a compact of water-saturated glass beads. While uncertainty in the permeability of the snow limits our ability to compare the observed and calculated onset of convection, agreement between the observed and calculated effects of convection on heat transfer in snow is good. Experimental results with glass beads agree with both the calculated onset of and heat transfer by convection. Attempts are made to assess the effects of convection on snow metamorphism. While much is still uncertain about the significance of thermal convection in snow, it is clear that the phenomenon does occur.

MP 2007

MODELLING A SNOWDRIFT BY MEANS OF ACTIVATED CLAY PARTICLES.

Anno, Y., *Annals of glaciology,* 1985, Vol.6, Symposium on Snow and Ice Processes at the Earth's Surface, Sapporo, Japan, Sep. 2-7, 1984. Proceedings, p.48-52, 12 refs.

40-2307

SNOWDRIFTS, SNOW MECHANICS, WATER CONTENT, MODELS, WIND VELOCITY, CLAY SOILS, SNOW FENCES.

MP 2008

ACIDITY OF SNOW AND ITS REDUCTION BY ALKALINE AEROSOLS.

Kumai, M., *Annals of glaciology,* 1985, Vol.6, Symposium on Snow and Ice Processes at the Earth's Surface, Sapporo, Japan, Sep. 2-7, 1984. Proceedings, p.92-94, 9 refs.

40-2317

SNOW COMPOSITION, CHEMICAL PROPERTIES, AEROSOLS, COUNTERMEASURES, SCANNING ELECTRON MICROSCOPY, HYDROGEN ION CONCENTRATION.

Snow crystals scavenge aerosols in the atmosphere during the processes of growth and precipitation. Several kinds of flyash are found in acid snow by scanning electron microscope examination. Flyash particles from coal fired electric power plants in Fairbanks, Alaska, were found to be spherical or irregular in shape with a 0.2 to 50 micron diameter, and were rich in calcium, silicon, aluminum and iron. The pH of 35 snow samples in Fairbanks ranged from 5.60 to 7.48. The acid snow was changed to alkaline snow by dry fallout of calcium-rich flyash from the electric power plants, which were using calcium-rich Alaskan coal.

MP 2009

ICE ACCRETION UNDER NATURAL AND LABORATORY CONDITIONS.

Itagaki, K., et al, *Annals of glaciology,* 1985, Vol.6, Symposium on Snow and Ice Processes at the Earth's Surface, Sapporo, Japan, Sep. 2-7, 1984. Proceedings, p.225-228, 13 refs.

Lemieux, G.E., Bosworth, H.W.

40-2351

AIRCRAFT ICING, ICE ACCRETION, WIND TUNNELS, UNFROZEN WATER CONTENT, TEMPERATURE FACTORS, HUMIDITY, PROPELLERS.

To compare results of icing studies conducted in wind tunnels with natural icing conditions, a series of rotor icing studies were made on top of Mt. Washington, New Hampshire. The results indicated that considerable differences exist between the two under conditions of similar liquid water content and temperature. The wet-to-dry growth transition temperature, for instance, with comparable temperature and liquid water content, may be more than 10 C higher under natural conditions than in wind tunnel studies. The possible cause of such discrepancies was found to be the vapor saturation existing in most laboratory experiments. The transition temperature of ice accretion measured in natural fog on board an aircraft agreed better with the results of the Mt. Washington study.

MP 2010

MEASUREMENT OF ICING ON OFFSHORE STRUCTURES.

Minsk, L.D., International Workshop on Offshore Winds and Icing, Halifax, Nova Scotia, Oct. 7-11, 1985. Proceedings. Edited by T.A. Agnew and V.R. Swail, Downsview, Ontario, Atmospheric Environment Service, 1985, p.287-292, 3 refs.

40-2509

ICING, OFFSHORE STRUCTURES, ICE ACCRETION, SEA SPRAY, SHIP ICING, SUPERSTRUCTURES, ICE DETECTION, PRECIPITATION (METEOROLOGY), LASERS.

MP 2011

WETTING OF POLYSTYRENE AND URETHANE ROOF INSULATIONS IN THE LABORATORY AND ON A PROTECTED MEMBRANE ROOF.

Tobiasson, W., et al, Hanover, NH, U.S. Army Cold Regions Research and Engineering Laboratory, Dec. 1984, 9p. + figs., 13 refs. Presented at the ASTM Committee C-16 Conference on Thermal Insulation, Materials and Systems, Dallas, TX, Dec. 2-6, 1984.

Greatorex, A., Van Pelt, D.

40-2549

ROOFS, THERMAL INSULATION, POLYMERS, CELLULAR PLASTICS, MOISTURE, TEMPERATURE GRADIENTS, TESTS.

When subjected to a sustained temperature gradient in the presence of moisture in laboratory wetting tests, urethane and expanded polystyrene roof insulations accumulate enough moisture to significantly reduce their insulating ability. Extruded polystyrene is quite resistant to moisture in such tests. But the vapor drive is not as great in actual roofs and it may reverse direction, thereby seasonally drying the insulation. To determine how well the laboratory tests could predict the wetting rate of insulation in actual protected membrane roofs, extruded and expanded polystyrene and urethane insulations were installed in a protected membrane roof in Hanover, N.H. After three years of exposure, little moisture had accumulated in the extruded polystyrene and it still retained essentially all of its initial insulating ability.

MP 2012

MOBILITY OF WATER IN FROZEN SOILS.

Lunardini, V.J., et al, Army Science Conference, June 15-18, 1982. Proceedings, [1982], c15p., 32 refs.

Berg, R., McGaw, R., Jenkins, T.F., Nakano, Y., Oliphant, J.L., O'Neill, K., Tice, A.

40-2543

FROZEN GROUND PHYSICS, SOIL WATER MIGRATION, THAW WEAKENING, FROST HEAVE, UNFROZEN WATER CONTENT, GROUND ICE, SOIL TEMPERATURE, MATHEMATICAL MODELS.

MP 2013

CONSTRAINTS AND APPROACHES IN HIGH LATITUDE NATURAL RESOURCE SAMPLING AND RESEARCH.

Slaughter, C.W., et al, Inventorying forest and other vegetation of the high latitude and high altitude regions; Proceedings of an international symposium, Fairbanks, AK, July 23-26, 1984. Edited by V.J. LaBau and C.L. Kerr, Bethesda, MD, Society of American Foresters, 1984, p.41-46, 37 refs.

Werner, R.A., Haugen, R.K.

40-1365

NATURAL RESOURCES, SNOW COVER EFFECT, PERMAFROST, METEOROLOGICAL FACTORS, REMOTE SENSING, SEASONAL VARIATIONS, AERIAL SURVEYS.

MP 2014

ICE PENETRATION TESTS.

Garcia, N.B., et al, *Cold regions science and technology,* Nov. 1985, 11(3), p.223-236, 6 refs.

Farrell, D., Mellor, M.

40-2611

ICE COVER STRENGTH, MILITARY RESEARCH, PROJECTILE PENETRATION, IMPACT STRENGTH, FLEXURAL STRENGTH, BRITTLENESS, PENETRATION TESTS.

Exploratory tests of ice penetration were made by driving small blunt cylinders into semi-infinite ice at normal incidence. Three types of laboratory tests were made: (1) drop-weight impact (impact speed 1.4-3.1 m/s), (2) high-speed ballistic penetration (impact speed 83-434 m/s), (3) deep penetration at low speed (0.42-4.23 m/s). Penetration by indenters and projectiles could be characterized by the energetics of the process, with little variation of specific energy as penetration speed changed by orders of magnitude. For blunt penetrators entering ice at -5 C, specific energy was typically in the range 1.5-15 MJ/cu m. Low speed tests provided data on penetration force (and energy) as a function of displacement. The test results were compared with other published laboratory data, and with field tests results for bigger projectiles.

MP 2015

STATISTICS OF COARSENING IN WATER-SATURATED SNOW.

Colbeck, S.C., *Acta metallurgica,* Mar. 1986, 34(3), p.347-352, With French and German summaries. 14 refs.

40-2659

SNOW WATER CONTENT, PARTICLE SIZE DISTRIBUTION, SLUSH, WET SNOW, SATURATION, STATISTICAL ANALYSIS.

The particle size distributions in water-saturated snow are distinctly log-normal at all times. The rate of increase of the average volume decreases somewhat with time. Both of these conclusions are contrary to the LSW theory, which should apply to this system. Also, the particles are distinctly spheroidal, probably prolate. These discrepancies might be explained by extending the LSW theory to nonspherical particles with interparticle contacts. When normalized to the mean the distribution is invariant with only the mean changing with time.

MP 2016

SYSTEM FOR MOUNTING END CAPS ON ICE SPECIMENS.

Cole, D.M., et al, *Journal of glaciology,* 1985, 31(109), p.362-365, 3 refs., With French and German summaries.

Gould, L.D., Burch, W.B.

40-2694

ICE CORES, ICE SAMPLING, EQUIPMENT, FREEZING, WATER TEMPERATURE, COMPRESSIVE PROPERTIES.

This short note describes the equipment and procedures developed to mount end caps on ice-core specimens. The system typically achieves end-plane parallelism within 0.5 micron/mm of specimen diameter (i.e. a total indicator runout of 0.002 in for a 4.0 in diameter specimen). The essential elements of the system are a holder and an alignment fixture. The holder firmly grips the ice core about its circumference by the compression of two series of O-rings. The alignment fixture clamps the holder to align the ice core precisely with the end caps. To bond the ice to the end cap we form a layer of 0 C water on the end cap; the water freezes immediately upon contact with the ice and forms a strong intimate bond. To date, this system has been used to install phenolic end caps on 101.6

mm diameter cores and aluminum end caps on 76.2 mm diameter cores of saline ice. A somewhat better tolerance was obtained with the aluminum caps, due primarily to the geometric stability of that material under the prevailing conditions. These specimens have been successfully tested in uniaxial and triaxial compression, and with appropriate end caps the system should be suitable for preparing tension specimens as well.

MP 2017
DETERIORATED BUILDING PANELS AT SONDRESTROM, GREENLAND.
Korhonen, C., *Northern engineer,* Spring 1985, 17(1), p.7-10, 4 refs.
40-1537
FROST ACTION, BUILDINGS, REINFORCED CONCRETES, THERMAL INSULATION, STRAINS, DAMAGE, WALLS, TEMPERATURE VARIATIONS, VAPOR PRESSURE, MOISTURE, GREENLAND.

MP 2018
CHARACTERISTIC FREQUENCY OF FORCE VARIATIONS IN CONTINUOUS CRUSHING OF SHEET ICE AGAINST RIGID CYLINDRICAL STRUCTURES.
Sodhi, D.S., et al, *Cold regions science and technology,* Feb. 1986, 12(1), p.1-12, 20 refs.
Morris, C.E.
40-2769
ICE LOADS, OFFSHORE STRUCTURES, ICE COVER STRENGTH, ICE SOLID INTERFACE, ICE PRESSURE, PILES, ICE BREAKING, VELOCITY, ICE COVER THICKNESS, TESTS, DAMAGE.

The ice forces generated during continuous crushing of an ice sheet against a cylindrical vertical structure vary with time, according to the resistance offered by ice as it fails and clears from the path of the structure. Small-scale experiments were performed to measure the ice forces by pushing rigid cylindrical structures of different diameters at different velocities through an ice sheet. The dominant frequency of ice force variations, defined as the characteristic frequency, was determined from the frequency spectra of the force records. The characteristic frequency plot with respect to the velocity-to-thickness ratio reveals a linear relationship, which implies that the average length of the damage zone is proportional to the ice thickness. On the basis of the data presented here, the average length of the damage zone is about one-third of the ice thickness.

MP 2019
WAVELENGTH-DEPENDENT EXTINCTION BY FALLING SNOW.
Koh, G., *Cold regions science and technology,* Feb. 1986, 12(1), p.51-55, 9 refs.
40-2773
SNOWFALL, LIGHT TRANSMISSION, INFRARED RADIATION, LIGHT SCATTERING, VISIBILITY, WAVE PROPAGATION, PARTICLES.

Wavelength-dependent extinction in the visible and infrared regions of the electromagnetic spectrum has been observed during studies of transmission through falling snow. The wavelength dependence was particularly noticeable during periods of light snowfall. Particles comparable in size to the wavelengths were also present during these periods. These particles were assumed to be water droplets, and their extinction cross-sections were determined from Mie scattering calculations. The calculations suggest that these particles were responsible for the wavelength-dependent extinction observed during snowfall.

MP 2020
ELECTROMAGNETIC MEASUREMENTS OF MULTI-YEAR SEA ICE USING IMPULSE RADAR.
Kovacs, A., et al, *Cold regions science and technology,* Feb. 1986, 12(1), p.67-93, 11 refs.
Morey, R.M.
40-2775
SEA ICE, ICE BOTTOM SURFACE, ELECTROMAGNETIC PROPERTIES, ICE STRUCTURE, BRINES, AIR ENTRAINMENT, RADIO ECHO SOUNDING, DIELECTRIC PROPERTIES, ICE PHYSICS, RADAR ECHOES.

Sounding of multi-year sea ice, using impulse radar operating in the 80- to 500-MHz frequency band, has revealed that the bottom of this ice cannot always be detected. This paper discusses a field program aimed at finding out why this is so, and at determining the electromagnetic (EM) properties of multi-year sea ice. It was found that the bottom of the ice could not be detected when the ice structure had a high brine content. Because of brine's high conductivity, brine volume dominates the loss mechanism in first-year sea ice, and the same was found true for multi-year ice. A two-phase dielectric mixing formula, used by the authors to describe the EM properties of first-year sea ice, was modified to include the effects of the gas pockets found in the multi-year ice. This three-phase mixture model was found to estimate the EM properties of the multiyear ice studied over the frequency band of interest.

MP 2021
THERMAL ANALYSIS OF A SHALLOW UTILIDOR.
Phetteplace, G., et al, [1986], 10p., 4 refs. Prepared for presentation at the 77th Annual Conference of the International District Heating and Cooling Association, June 8-12, 1986, Ashville, NC.
Richmond, P.W., Humiston, N.
40-3359
WASTE DISPOSAL, THERMAL PROPERTIES, UTILITIES, THERMAL CONDUCTIVITY, HEATING, WATER PIPELINES, AIR TEMPERATURE, DESIGN, COUNTERMEASURES, FREEZING.

MP 2022
AERIAL ROOF MOISTURE SURVEYS.
Tobiasson, W., *Military engineer,* Aug. 1985, 77(502), p.424-425.
40-2854
ROOFS, MOISTURE DETECTION, INFRARED PHOTOGRAPHY, PENETRATION, SURVEYS.

MP 2023
EVALUATING TRAFFICABILITY.
McKim, H.L., *Military engineer,* Aug. 1985, 77(502), p.474-475.
40-2855
TRAFFICABILITY, SOIL WATER, FROST PENETRATION, WATER CONTENT, TRACKED VEHICLES.

MP 2024
COLD FACTOR.
Abele, G., *Military engineer,* Aug. 1985, 77(502), p.480-481.
40-2857
COLD WEATHER CONSTRUCTION, COLD WEATHER OPERATION, MILITARY ENGINEERING, TEMPERATURE EFFECTS, WIND VELOCITY, SNOWFALL, TIME FACTOR, WIND CHILL, ENVIRONMENTS.

MP 2025
GEOTECHNICAL PROPERTIES AND FREEZE/THAW CONSOLIDATION BEHAVIOR OF SEDIMENT FROM THE BEAUFORT SEA, ALASKA.
Lee, H.J., et al, *U.S. Geological Survey. Open-file report,* Oct. 1985, 85-612, 83p., 23 refs.
Winters, W.J., Chamberlain, E.J.
40-2868
BOTTOM SEDIMENT, FREEZE THAW CYCLES, SOIL COMPACTION, SUBSEA PERMAFROST, GROUND ICE, ICE SCORING, OCEAN BOTTOM, SEASONAL FREEZE THAW, OFFSHORE STRUCTURES.

MP 2026
SEA ICE MICROBIAL COMMUNITIES IN ANTARCTICA.
Garrison, D.L., et al, *BioScience,* Apr. 1986, 36(4), p.243-250, 38 refs.
Sullivan, C.W., Ackley, S.F.
40-2922
SEA ICE, MICROBIOLOGY, BACTERIA, MARINE BIOLOGY, CRYOBIOLOGY, ANTARCTICA—MCMURDO SOUND, ANTARCTICA—WEDDELL SEA.

The role of sea ice community inhabitants as the sub-bottom element in the antarctic food web is reviewed. Sea ice formation is described and the several denizens of this habitat are identified. They serve as food for krill which have been found in brine channels in the ice of McMurdo Sound and the Weddell Sea. Their behaviors, geographic distributions, and populations in antarctic waters are the objects of continuing long term studies.

MP 2027
TOPICAL DATABASES: COLD REGIONS TECHNOLOGY ON-LINE.
Liston, N., et al, *Chemical engineering progress,* Jan. 1986, p.12-15, Also presented at the Arctic Offshore Technology Conference and Exposition, Anchorage, Alaska, Sep. 3-5, 1985. Proceedings.
Winiarski, M.E.
40-2996
ICE SURVEYS, COMPUTER APPLICATIONS, SNOW SURVEYS, OFFSHORE STRUCTURES, OFFSHORE DRILLING, BIBLIOGRAPHIES, PERMAFROST, ORGANIZATIONS, ENGINEERING.

MP 2028
EFFECT OF FREEZING ON THE LEVEL OF CONTAMINANTS IN UNCONTROLLED HAZARDOUS WASTE SITES. PART 1. LITERATURE REVIEW AND CONCEPTS.
Iskandar, I.K., et al, Annual Research Symposium on Land Disposal of Hazardous Waste, 11th, Cincinnati, Ohio, Apr. 29-May 1, 1985. Proceedings, Cincinnati, OH, U.S. Environmental Protection Agency, [1985], p.122-129, 21 refs.
Houthoofd, J.M.
40-2952
WASTE TREATMENT, WASTE DISPOSAL, SOIL FREEZING, ARTIFICIAL FREEZING, ION DIFFUSION, FROST ACTION, SLUDGES, COUNTERMEASURES, SOIL POLLUTION, ENVIRONMENTAL PROTECTION.

A literature search indicated that natural freezing may have detrimental effects at uncontrolled hazardous waste sites in the cold-dominated areas because of frost action on buried materials and ion movement in soils. Natural and artificial freezing, however, can be used beneficially to concentrate effluents, and to dewater sludges, contaminated sediment and soils. The process of artificial ground freezing can also be used as an alternative to temporarily immobilize contaminant transport and potentially for decontamination of soils, sediments and sludges. A cost and economic analysis procedure was developed and used to evaluate ground freezing.

MP 2029
POTENTIAL USE OF ARTIFICIAL GROUND FREEZING FOR CONTAMINANT IMMOBILIZATION.
Iskandar, I.K., et al, [1985], 10p., Reprinted from International Conference on New Frontiers for Hazardous Waste Management, Pittsburg, PA, Sep. 15-18, 1985. Proceedings. 14 refs.
Jenkins, T.F.
40-2951
WASTE TREATMENT, ARTIFICIAL FREEZING, SOIL FREEZING, FREEZE THAW CYCLES, SOIL POLLUTION, COUNTERMEASURES, WASTE DISPOSAL, ENVIRONMENTAL PROTECTION.

This paper summarizes a preliminary investigation of the potential use of ground freezing technology for contaminant immobilization. Freezing and thawing were found to significantly decrease the volume of soil slurry and increase the permeability of soils. Frozen metal-contaminated soils eliminated metal leaching to groundwater under the site. Freezing and thawing soils contaminated with moderately volatile organics significantly reduced the soil concentrations of these organics. Freezing the soil from the bottom apparently enhanced upward movement of the organics to the soil surface where losses occurred by volatilization. The amount lost depended on the mobility of the specific volatile component and was as high as 90% for chloroform, benzene and toluene and as low as 45% for tetrachloroethylene. Input to groundwater during freezing and thawing of these organics was much less than the unfrozen (control) treatment. Artificial ground freezing for decontamination of soils and for immobilization of contaminants is now being tested on a larger scale

MP 2030
ECONOMICS OF GROUND FREEZING FOR MANAGEMENT OF UNCONTROLLED HAZARDOUS WASTE SITES.
Sullivan, J.M., Jr., et al, [1985], 15p., National Conference on Management of Uncontrolled Hazardous Waste Sites, 5th, Washington, D.C., Nov. 7-9, 1984. Proceedings. 26 refs.
Lynch, D.R., Iskandar, I.K.
40-2950
WASTE TREATMENT, SOIL FREEZING, ARTIFICIAL FREEZING, WASTE DISPOSAL, SOIL WATER, THERMAL PROPERTIES, LATENT HEAT, ENVIRONMENT PROTECTION, REFRIGERATION.

Ground freezing for hazardous waste containment is an alternative to the traditional and expensive slurry wall or grout curtain barrier technologies. The parameters quantified in this analysis of it include thermal properties, refrigeration line spacing, equipment mobilization and freezing time constraints. The economics of the process is discussed based on the Poetsch method for ground freezing. Vertical drill holes with concentric refrigeration lines are spaced along the desired freezing line. A header or manifold system provides coolant to an interior pipe, with the return line being the outer casing. A self-contained refrigeration system pumps coolant around the freezing loop. Temperature-measuring instrumentation is appropriately placed to monitor the progress of the freeze front.

MP 2031

PROCEEDINGS.

International Offshore Mechanics and Arctic Engineering (OMAE) Symposium, 5th, Tokyo, Apr. 13-18, 1986, New York, American Society of Mechanical Engineers, 1986, 4 vols., Refs. passim. For selected papers see 40-3104 through 40-3199.

Chung, J.S., ed.

40-3103

OFFSHORE STRUCTURES, OFFSHORE DRILLING, ICE LOADS, ICE CONDITIONS, ENGINEERING, MEETINGS, ICE MECHANICS, ICE SOLID INTERFACE, IMPACT STRENGTH, ICE STRENGTH.

MP 2032

ICE PROPERTIES IN A GROUNDED MAN-MADE ICE ISLAND.

Cox, G.F.N., et al, International Offshore Mechanics and Arctic Engineering (OMAE) Symposium, 5th, Tokyo, Apr. 13-18, 1986. Proceedings, Vol.4, New York, American Society of Mechanical Engineers, 1986, p.135-142, 19 refs.

Utt, M.E.

40-3129

ICE ISLANDS, GROUNDED ICE, ICE SALINITY, ICE TEMPERATURE, ICE DENSITY, SHEAR STRENGTH, ICE LOADS, ARTIFICIAL ISLANDS, TESTS, OFFSHORE STRUCTURES.

Salinity, temperature, density, and shear strength tests were performed on the confined flooded ice in the 1976-77 East Harrison Bay grounded ice island. The constructed ice had a mean salinity of 13.8 ppt, a mean density of 877 kg/cu m, and a mean horizontal shear strength of 0.74 MPa. The shearing resistance of the constructed ice and the sliding resistance of the island on the sea floor were sufficient to prevent the island from being pushed off location by ice movement.

MP 2033

FREE AND FORCED CONVECTION HEAT TRANSFER IN WATER OVER A MELTING HORIZONTAL ICE SHEET.

Lunardini, V.J., International Offshore Mechanics and Arctic Engineering (OMAE) Symposium, 5th, Tokyo, Apr. 13-18, 1986. Proceedings, Vol.4, New York, American Society of Mechanical Engineers, 1986, p.227-236, 24 refs.

40-3142

ICE MELTING, HEAT TRANSFER, WATER FLOW, ICE TEMPERATURE, ICE SHEETS, WATER TEMPERATURE, CONVECTION.

Experiments were conducted to study the melting of a horizontal ice sheet with a flow of water above it. The experiments were conducted in a refrigerated flume 35 m long with a cross section of 1.2 x 1.2 m. Water depth, temperature, and velocity were varied as well as the temperature and initial surface profile of the ice sheet. It was found that the heat transfer regimes consisted of forced turbulent flow at high Reynolds numbers with a transition to free convection heat transfer at lower Reynolds numbers. There was no convincing evidence of a forced laminar regime.

MP 2034

HEAT TRANSFER CHARACTERISTICS OF THERMOSYPHONS WITH INCLINED EVAPORATOR SECTIONS.

Haynes, F.D., et al, International Offshore Mechanics and Arctic Engineering (OMAE) Symposium, 5th, Tokyo, Apr. 13-18, 1986. Proceedings, Vol.4, New York, American Society of Mechanical Engineers, 1986, p.285-292, 21 refs.

Zarling, J.P.

40-3150

HEAT TRANSFER, EVAPORATION, PERMAFROST THERMAL PROPERTIES, THERMAL CONDUCTIVITY, PERMAFROST BENEATH STRUCTURES, FOUNDATIONS, WIND VELOCITY, AIR TEMPERATURE, TESTS, THAW DEPTH.

Laboratory tests were conducted on two commercial full-size thermosyphons, one charged with carbon dioxide and one with ammonia. The test variables were evaporator inclinational angle, wind speed and ambient air temperature. Empirical expressions are presented for thermal conductance as a function of these test variables. The laboratory test results were used in finite element simulations run on an IBM-PC microcomputer to study three design parameters influencing the thermal regime below slab-on-grade foundations in a permafrost location. Insulation thickness, thermosyphon conductance and vertical placement were varied in these simulations. The effect of these variables on the maximum depth of thaw are given.

MP 2035

CONFINED COMPRESSIVE STRENGTH OF MULTI-YEAR PRESSURE RIDGE SEA ICE SAMPLES.

Cox, G.F.N., et al, International Offshore Mechanics and Arctic Engineering (OMAE) Symposium, 5th, Tokyo, Apr. 13-18, 1986. Proceedings, Vol.4, New York, American Society of Mechanical Engineers, 1986, p.365-373, 17 refs.

Richter-Menge, J.A.

40-3162

PRESSURE RIDGES, ICE STRENGTH, COMPRESSIVE PROPERTIES, LOADS (FORCES), SEA ICE, STRAIN TESTS, TEMPERATURE EFFECTS, PRESSURE, STRESSES.

Fifty-five constant-strain-rate triaxial tests were performed on vertically oriented multi-year pressure ridge samples from the Beaufort Sea. The tests were performed on a closed-loop electrohydraulic testing machine at two nominal strain rates (1/100,000 and 1/1,000 per sec) and two temperatures (-20 and -5 C). In all of the tests the confining pressure was ramped in constant proportion to the applied axial stress. This paper summarizes the sample preparation and testing techniques used in this investigation and presents data on the confined compressive strength and failure strain of the ice. Uniaxial data are also included for comparison.

MP 2036

SOME EFFECTS OF FRICTION ON ICE FORCES AGAINST VERTICAL STRUCTURES.

Kato, K., et al, International Offshore Mechanics and Arctic Engineering (OMAE) Symposium, 5th, Tokyo, Apr. 13-18, 1986. Proceedings, Vol.4, New York, American Society of Mechanical Engineers, 1986, p.528-533, 17 refs.

Sodhi, D.S., Haynes, D.

40-3184

ICE LOADS, ICE FRICTION, OFFSHORE STRUCTURES, ICE BREAKING, ICE SOLID INTERFACE, ICE CONDITIONS.

The contributions of frictional forces to the overall ice forces exerted against sloping structures have been studied before, but their effect on the ice forces against vertical structures has not yet been studied. In this paper, the influence of frictional resistance on the crushing and buckling failure loads of ice sheets against flat, vertical structures is discussed. Small-scale experiments were conducted to compare experimental results to those from theoretical formulations. The main conclusions of this study are: a) the crushing ice forces increase with increasing coefficient of friction between ice and structure, and b) the buckling failure loads also increase due to changes in boundary condition induced by increasing frictional resistance at the ice/structure interface.

MP 2037

IMPACT ICE FORCE AND PRESSURE: AN EXPERIMENTAL STUDY WITH UREA ICE.

Sodhi, D.S., et al, International Offshore Mechanics and Arctic Engineering (OMAE) Symposium, 5th, Tokyo, Apr. 13-18, 1986. Proceedings, Vol.4, New York, American Society of Mechanical Engineers, 1986, p.569-576, 10 refs.

Morris, C.E.

40-3190

ICE LOADS, ICE PRESSURE, OFFSHORE STRUCTURES, IMPACT STRENGTH, PILES, VELOCITY, UREA, EXPERIMENTATION, COMPRESSIVE PROPERTIES.

An experimental study was undertaken of the total force and local pressure generated during the impact of a vertical cylindrical structure against the edge of an ice sheet. The test structure was an instrumented cylindrical pile that protruded under a massive ram suspended from two cranes in the form of a bifilar pendulum. Measurements were made of impact velocity, total ice force, and pressure at a point on the pile. The dependence of normalized maximum ice forces with respect to aspect ratio has the same trend as that for the crushing failure of an ice sheet against a vertical structure. The results of this study indicate that the instantaneous maximum pressure can be an order of magnitude higher than the unconfined compressive strength of ice.

MP 2038

ICE FLOE DISTRIBUTION IN THE WAKE OF A SIMPLE WEDGE.

Tatinclaux, J.C., International Offshore Mechanics and Arctic Engineering (OMAE) Symposium, 5th, Tokyo, Apr. 13-18, 1986. Proceedings, Vol.4, New York, American Society of Mechanical Engineers, 1986, p.622-629, 6 refs.

40-3198

ICE BREAKING, ICE WEDGES, ICE FLOES, SEA ICE DISTRIBUTION, ICEBREAKERS, ICE STRENGTH, ICE COVER THICKNESS, ICE MODELS, ICE CONDITIONS, TESTS.

Tests in level ice on an idealized icebreaker bow in the shape of a simple wedge were conducted and the floe size distribution in its wake was observed. The ice floe length and ice floe area were found to follow log-normal probability distributions defined by the length average and area average, and corresponding standard deviations.

MP 2039

CONDENSATION CONTROL IN LOW-SLOPE ROOFS.

Tobiasson, W., Moisture Control in Buildings: Workshop proceedings, Sep. 25-26, 1984. Edited by E. Bales and H. Trechsel, Washington, D.C., Building Thermal Envelope Coordinating Council, ₍1985₎, p.47-59, 47 refs.

40-3204

ROOFS, CONDENSATION, MOISTURE, VAPOR TRANSFER, AIR FLOW, COUNTERMEASURES, BUILDINGS, DAMAGE, CONSTRUCTION MATERIALS, MAINTENANCE.

Excessive moisture can damage wood, metal, and concrete roof decks, cause bituminous membranes to wrinkle, shrink, split, delaminate and blister and significantly reduce the insulating ability of most roof insulations. Low-sloped wood-frame roofs with below-deck insulation have encountered a significant number of condensation problems. Few such problems occur for compact membrane roofs without intervening air spaces. Air leakage control probably explains the difference. However, serious condensation problems occur in some compact membrane roofs, particularly in cold regions. For most roofs, upward vapor flow in cold weather is generally exceeded by downward vapor flow in warm weather. Thus, the objective is to install air-vapor retarders to reduce winter wetting to an acceptable level. Ventilation of the space between the membrane and the retarder is also practiced.

MP 2040

ROOF MOISTURE SURVEYS: YESTERDAY, TODAY AND TOMORROW.

Tobiasson, W., et al, International Symposium on Roofing Technology, 1985. Proceedings. A decade of change and future trends in roofing, Chicago, IL, National Roofing Contractors Association, ₍1985₎, p.438-443 + figs., 45 refs.

Korhonen, C.

40-3203

ROOFS, MOISTURE DETECTION, THERMAL INSULATION, CONDENSATION, MEASURING INSTRUMENTS.

Roof moisture surveys are conducted with nuclear meters, capacitance meters or infrared scanners. Nuclear meters and capacitance meters take readings at the spots on the roof with points spaced from 5 to 10 feet apart. Nuclear meters sense the amount of hydrogen in the roofing system at each spot. Since most dry roofs contain hydrocarbons, they do not give zero readings. When water also is present on the roof, nuclear readings increase since water is part hydrogen. Capacitance meters create an alternating current electrical field in the roofing system below. When there is water in the roof, its dielectric properties change and the reading on the capacitance meter increases. Capacitance meters do not "see" deeply (a few inches at most) into the roofing system. An infrared scanner senses the temperature of the surface of the roof. Wet insulation changes the ability of the roofing system to store and conduct thermal energy, thereby causing changes in its surface temperature which the infrared scanner can detect. Instead of a meter reading, the infrared results are presented as shades of brightness on a video monitor. This qualitative visual image provides information about every square inch of the roof, but the information is more subjective than the numbers generated at grid points by nuclear or capacitance meters.

MP 2041

VAPOR DRIVE MAPS OF THE U.S.A.

Tobiasson, W., et al, Hanover, NH, Cold Regions Research and Engineering Laboratory, ₍1986₎, 7p. + graphs, 9 refs. Presented at the ASHRAE/DOE/BTECC Conference "Thermal Perforamnce of the Exterior Envelopes of Buildings III", Clearwater Beach, FL, Dec. 1985.

Harrington, M.

40-3202

THERMAL INSULATION, CONDENSATION, MOISTURE, WATER VAPOR, MAPS, BUILDINGS, METEOROLOGICAL FACTORS, DESIGN CRITERIA, SEASONAL VARIATIONS.

The thermal performance of most insulations used in building envelopes will be seriously degraded if the insulation becomes wet. Problematic moisture can come from within the building envelope. Guidance on when to use "air-retarders" needs improvement. As a step in this direction, weather records have been analyzed and two series of maps have been made that relate the relative humidity within a building to the vapor pressure gradients across the building envelope. Each map in the first series is for a specific ratio of cold weather wetting potential to warm weather drying potential. Each map in the second series is for a specific cold weather wetting potential. To determine which map in each series is most appropriate to use as design criteria, we are requesting guidance from the building profession.

MP 2042

HEAT FLOW SENSORS ON WALLS—WHAT CAN WE LEARN.

Flanders, S.N., *American Society for Testing and Materials. Special technical testing publication,* 1985, No.885, p.140-149, 10 refs.

40-3226

THERMAL INSULATION, WALLS, HEAT TRANSFER, HEAT FLUX, HEAT LOSS, BUILDINGS, ACCURACY, THERMAL CONDUCTIVITY.

This paper addresses the validity of employing heat flow sensors (HFSs) on the indoor surfaces of building walls to determine thermal characteristics. It also reports on the results obtained in the field. Some of the factors affecting HFS measurement accuracy (together with a likely percentage standard deviation attributable to that factor) are as follows: (a) the conductivities of HFS and its surroundings (3%), (b) convection mode changing over the sensor, causing a +21% bias (26%), (c) the mismatch of HFS absorptivity with the surroundings (6%), and (d) thermal contact of the HFS with the surface (1%). A propagation-of-errors analysis indicates that the resulting standard deviation of an HFS measurement would be approximately 10% of the mean of the measurements.

MP 2043

NEED FOR SNOW TIRE CHARACTERIZATION AND EVALUATION.

Yong, R.N., et al, *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* Sep. 1985, No.SR 85-15, ISTVS Workshop on Measurement and Evaluation of Tire Performance under Winter Conditions, Alta, Utah, Apr. 11-14, 1983. Proceedings. Edited by G.L. Blaisdell and R.N. Yong, p.1-2, ADA-161 129.

Blaisdell, G.L.

40-3321

TIRES, COLD WEATHER PERFORMANCE, TRACKED VEHICLES, SNOW COVER EFFECT, TRACTION.

MP 2044

DESIGN AND USE OF THE CRREL INSTRUMENTED VEHICLE FOR COLD REGIONS MOBILITY MEASUREMENTS.

Blaisdell, G.L., *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* Sep. 1985, No.SR 85-15, ISTVS Workshop on Measurement and Evaluation of Tire Performance under Winter Conditions, Alta, Utah, Apr. 11-14, 1983. Proceedings. Edited by G.L. Blaisdell and R.N. Yong, p.9-20, ADA-161 129, 2 refs.

40-3323

MOTOR VEHICLES, COLD WEATHER PERFORMANCE, TRACTION, VEHICLE WHEELS, RUBBER SNOW FRICTION, RUBBER ICE FRICTION, DESIGN, VELOCITY, LOADS (FORCES), MEASURING INSTRUMENTS.

The U.S. Army Cold Regions Research and Engineering Laboratory has recently acquired an instrumented vehicle for the measurement of forces at the tire/surface material interface. The CRREL instrumented vehicle (CIV) is equipped with moment-compensated triaxial load cells mounted in the front wheel assemblies. Forces are measured in the vertical, longitudinal (in the direction of motion) and side directions. In addition, accurate wheel and vehicle speeds and rear axle torque and speed are measured. Modifications to the vehicle (to facilitate the performance of traction and motion resistance tests) include four lock-out type hubs to allow front-, rear- or four-wheel drive and a dual brake system for front-, rear- or four-wheel braking. A minicomputer-based data acquisition system is installed in the vehicle to control data collection and for data processing, analysis and display. Discussion of the vehicle includes its operation and use for the evaluation of the tire performance and surface material properties of motion resistance and traction.

MP 2045

WINTER TIRE TESTS: 1980-81.

Blaisdell, G.L., et al, *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* Sep. 1985, No.SR 85-15, ISTVS Workshop on Measurement and Evaluation of Tire Performance under Winter Conditions, Alta, Utah, Apr. 11-14, 1983. Proceedings. Edited by G.L. Blaisdell and R.N. Yong, p.135-151, ADA-161 129, 2 refs.

Harrison, W.L.

40-3333

TIRES, ICE COVER EFFECT, SNOW COVER EFFECT, MOTOR VEHICLES, COLD WEATHER PERFORMANCE, SURFACE PROPERTIES, TESTS, ROAD ICING, TRACTION.

MP 2046

FIELD DEMONSTRATION OF TRACTION TESTING PROCEDURES.

Blaisdell, G.L., *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* Sep. 1985, No.SR 85-15, ISTVS Workshop on Measurement and Evaluation of Tire Performance under Winter Conditions, Alta, Utah, Apr. 11-14, 1983. Proceedings. Edited by G.L. Blaisdell and R.N. Yong, p.176, ADA-161 129.

40-3335

SNOW COVER EFFECT, TRACTION, MOTOR VEHICLES, TIRES, TESTS, MEASURING INSTRUMENTS.

MP 2047

PHYSICAL PROPERTIES OF THE SEA ICE COVER.

Weeks, W.F., Nordic seas. Edited by B.G. Hurdle, New York, Springer-Verlag, 1986, p.87-102, Refs. p.98-100.

40-3378

ICE STRUCTURE, ICE COMPOSITION, SEA ICE, ICE PHYSICS, ICE COVER THICKNESS, ICE FORMATION, SNOW COVER, ICE CRYSTAL STRUCTURE, ARCTIC OCEAN.

MP 2048

LARGE-SIZE COAXIAL WAVEGUIDE TIME DOMAIN REFLECTOMETRY UNIT FOR FIELD USE.

Delaney, A.J., et al, *IEEE transactions on geoscience and remote sensing,* Sep. 1984, GE-22(5), p.428-431, 10 refs.

Arcone, S.A.

40-3307

FROZEN GROUND PHYSICS, ICE ELECTRICAL PROPERTIES, DIELECTRIC PROPERTIES, GROUND THAWING, WAVE PROPAGATION, REFLECTION, MEASURING INSTRUMENTS.

A large-diameter open-ended coaxial waveguide has been interfaced with a commercially available time domain reflectometry (TDR) unit for field measurements of the dielectric properties of frozen and thawed soils and ice. A core barrel developed by the U.S. Army Cold Regions Research and Engineering Laboratory (CRREL) and modified for use in frozen soil was used to auger an annular slot around which the waveguide fits. Time domain traces of waveforms reflected from the sample-air interface and from a metal short are recorded in the field and later analyzed to give complex dielectric permittivity between 0.05 and 1.0 GHz.

MP 2049

REVERSED-PHASE HIGH-PERFORMANCE LIQUID CHROMATOGRAPHIC DETERMINATION OF NITROORGANICS IN MUNITIONS WASTEWATER.

Jenkins, T.F., et al, *Analytical chemistry,* Jan. 1986, 58(1), p.170-175, 32 refs.

Leggett, D.C., Grant, C.L., Bauer, C.F.

40-3356

WASTE TREATMENT, WATER TREATMENT, WATER CHEMISTRY, DETECTION, WATER POLLUTION, GROUND WATER.

Concentrations of HMX, RDX, TNT, and 2,4-DNT are determined in munitions wastewater. Aqueous samples are diluted with an equal volume of 76/24 (v/v) methanol-acetronitrile, filtered through a 0.4 microgram polycarbonate membrane, and analyzed by reversed-phase HPLC using an LC-8 column with 50/38/12 (v/v/v) water-methanol-acetonitrile. The method provided linear calibration curves to at least several hundred micrograms per liter. Detection limits were conservatively estimated to be 26, 22, 14, and 10 microgram/L for HMX, RDX, TNT, and 2,4-DNT, respectively, with corresponding standard deviations of 3.4, 3.3, 4.4, and 4.6 microgram/L up to concentrations of 250 microgram/L. At higher concentrations, the percent relative standard deviation values were approximately 2% for HMX and RDX and 4% for TNT and DNT. A ruggedness test involving the major manipulative steps in the procedure indicated that consistent results required glass sample containers, preconditioning of filters, and careful maintenance of sample-to-organic solvent ratio. The method was tested with munition wastewater from several Army ammunition plants and found to perform adequately for load and pack wastewaters, wastewater from HMX/RDX manufacture, and contaminated groundwater.

MP 2050

INTERLABORATORY EVALUATION OF HIGH-PERFORMANCE LIQUID CHROMATOGRAPHIC DETERMINATION OF NITROORGANICS IN MUNITION PLANT WASTEWATER.

Bauer, C.F., et al, *Analytical chemistry,* Jan. 1986, 58(1), p.176-182, 11 refs.

Grant, C.L., Jenkins, T.F.

40-3357

WASTE TREATMENT, WATER TREATMENT, WATER POLLUTION, CHEMICAL ANALYSIS, WATER CHEMISTRY, COUNTERMEASURES, TESTS.

A reversed-phase HPLC method for the determination of nitroorganic compounds (DNT, TNT, RDX, HMX) in munitions wastewaters was evaluated in a collaborative study. Nine laboratories analyzed four aqueous matrices, including groundwater and treated wastewater, which were spiked with the analytes at levels from 30 to 600 microgram/L. Recoveries of analytes were similar regardless of matrix: DNT and RDX being recovered quantitatively, and TNT and HMX showing losses of about 5%. Intralaboratory precisions, based on the average of duplicate determinations, were less than 15 microgram/L, which corresponds to 9% relative standard deviation at the average concentration examined. Interlaboratory precisions were at most 50% larger than intralaboratory values. Valid statistical analysis required rejection of about 10% of the data set as outliers. The rationale for applying a variety of statistical evaluations is discussed.

MP 2051

MATHEMATICAL SIMULATION OF NITROGEN INTERACTIONS IN SOILS.

Selim, H.M., et al, *Mathematics and computers in simulation,* June 1983, 25(3), p.241-248, 21 refs.

Mehran, M., Tanji, K.K., Iskandar, I.K.

40-3464

SOIL CHEMISTRY, GAS INCLUSIONS, WASTE DISPOSAL, GROUND WATER, NITROGEN, WATER FLOW, INTERFACES, MATHEMATICAL MODELS, CONVECTION, AGRICULTURE.

Four mathematical models were evaluated for their ability to describe the fate of nitrogen (N) in the soil environment. The first model is a general one which accounts for convective-dispersive N transport under transient water flow conditions with active N uptake by plants. Model II considers N transport to be only of the convective type, whereas model III considers N uptake as a passive process. In contrast, model IV considers N transport under conditions of steady water flow in the convective model (II) and the steady state model (IV) are inferior in describing N flow in the soil system as well as the convective dispersive transport mechanisms must be considered for reliable simulation of N behavior in the soil environment.

MP 2052

MEASUREMENT OF THE RESISTANCE OF IMPERFECTLY ELASTIC ROCK TO THE PROPAGATION OF TENSILE CRACKS.

Peck, L., et al, *Journal of geophysical research,* Aug. 10, 1985, 90(B9), p.7827-7836, 35 refs.

Nolen-Hoeksema, R.C., Barton, C.C., Gordon, R.B.

40-3466

ROCKS, CRACK PROPAGATION, ELASTIC PROPERTIES, TENSILE PROPERTIES, FRACTURING, STRENGTH, TESTS.

Laboratory tests confirm the accuracy of the compliance equations for wedge-loaded, linearly elastic, double cantilever beam test specimens used for the measurement of fracture energy G(I) but show that there are significant discrepancies with theory in tests on rock specimens of the same design. The dependence of the compliance on the length of the crack in the test specimen is not correctly predicted by theory for the experiments done on rock. The axial load applied to the arms of the double cantilever beam as a result of wedge loading reduces Young's modulus by as much as 44% and decreases the measured elastic anisotropy of specimens of granite. The experiments show that useful measurements of G(I) can be made on rock provided that the Young's modulus used in the determination of G(I) is measured on the same specimen under the same conditions of loading as are used in the fracture experiments.

MP 2053

ON ZERO-INERTIA AND KINEMATIC WAVES.

Katopodes, N.D., *American Society of Civil Engineers. Hydraulics Division. Journal,* Nov. 1982, 108(HY11), p.1381-1387, 5 refs. Discussion by M.G. Ferrick, Journal of hydraulic engineering, Mar. 1984, 110(3), p.352-357, 8 refs.

Ferrick, M.G.

40-3483

RIVER FLOW, WAVE PROPAGATION, WATER WAVES, CHANNELS (WATERWAYS), MATHEMATICAL MODELS.

MP 2054

PROCEEDINGS.

Symposium on Applied Glaciology, 2nd, West Lebanon, N.H., Aug. 23-27, 1982, *Annals of glaciology,* 1983, Vol.4, 314p., Refs. passim. For individual papers see 37-4071 through 37-4120.

Colbeck, S.C., ed.

37-4070

GLACIOLOGY, PERMAFROST, ICE SURVEYS, SNOW SURVEYS, AVALANCHES, SEA ICE.

MP 2055

EQUATIONS FOR DETERMINING THE GAS AND BRINE VOLUMES IN SEA-ICE SAMPLES.

Cox, G.F.N., et al, *Journal of glaciology,* 1983, 29(102), p.306-316, In English with French and German summaries. 13 refs.

Weeks, W.F.

38-1476

SEA ICE, BRINES, GAS INCLUSIONS, ICE DENSITY, MATHEMATICAL MODELS.

Equations are developed that can be used to determine the amount of gas present in sea ice from measurements of the bulk ice density, salinity, and temperature in the temperature range of -2 to -30 C. Conversely these relationships can be used to give the density of sea ice as a function of its temperature and salinity, considering both the presence of gas and of solid salts in the ice. Equations are also given that allow the calculation of the gas and brine volumes in the ice at temperatures other than that at which the bulk density was determined. (Auth.)

MP 2056
SURFACE INTEGRAL METHOD FOR DETERMINING ICE LOADS ON OFFSHORE STRUCTURES FROM *IN SITU* MEASUREMENTS.
Johnson, J.B., *Annals of glaciology,* 1983, Vol.4, p.124-128, 23 refs.
37-4091
ICE LOADS, OFFSHORE STRUCTURES, ICE SOLID INTERFACE, MATHEMATICAL MODELS, SHEAR STRESS, FLOATING ICE.

MP 2057
MEASUREMENTS OF RADAR WAVE SPEEDS IN POLAR GLACIERS USING A DOWN-HOLE RADAR TARGET TECHNIQUE.
Jezek, K.C., et al, *Cold regions science and technology,* Oct. 1983, 8(2), p.199-208, 17 refs.
Roeloffs, E.A.
38-1514
RADAR ECHOES, WAVE PROPAGATION, GLACIER ICE, ELECTRICAL RESISTIVITY, ANTARCTICA—VICTORIA LAND, GREENLAND.

A new technique for measuring the speed of radar waves in polar ice sheets was developed to investigate a previously reported disagreement between the permittivities of laboratory and glacier ice. The technique involves lowering a cylindrical radar target to several carefully measured depths in a borehole and measuring the travel time of a radar wave transmitted from a surface radar unit to the target in the borehole. The experiment was performed at Dome C, East Antarctica, and Dye-3, Greenland, and useable data were collected for target depths between 200 and 800m. After computing the range to the target along a straight ray path and after correcting the travel time for delays in in the radar receiver, the velocities determined from these experiments were found to be in good agreement with the velocities predicted by Robin's empirical formula. The apparent discrepancy between the permittivity of glacier ice, as measured using the radar wide-angle reflection method, and laboratory ice now seems to be due in large part to signal delay in the radar receiver that was ignored in earlier experiments. (Auth.)

MP 2058
RECENT CHANGES IN THE DYNAMIC CONDITION OF THE ROSS ICE SHELF, ANTARCTICA.
Jezek, K.C., *Journal of geophysical research,* Jan. 10, 1984, 89(B1), p.409-416, 9 refs.
38-1742
ICE SHELVES, FLOW RATE, RADAR ECHOES, ICE COVER THICKNESS, ANTARCTICA—ROSS ICE SHELF, ANTARCTICA—SIPLE COAST, ANTARCTICA—CRARY ICE RISE.

Variations in the amplitude of radar echoes from the bottom of the grid western half of the Ross Ice Shelf have been analyzed. Contrary to the results of a similar analysis performed for the grid eastern sector of the ice shelf, bands of low signal strength downstream from both Crary Ice Rise and the Siple Coast do not correlate with modern flow lines. The difference in direction between the radar bands downstream of Crary Ice Rise and the present velocity vectors and the absence of of a comparable trend farther east suggest to us that the grounding line around Crary Ice Rise retreated within the last 1000 years. This hypothesis is reinforced by the observation of several domes and hollows in ice thickness downstream of Crary Ice Rise which are similar to a hollow now located in the wake of the ice rise and a dome of its eastern flank. We interpret this as evidence for a rapid increase in flow around the ice rise which carried downstream the ice topography formed around the ice rise. Similar but less detailed evidence found downstream of the Siple Coast suggests that there was a regional retreat of the West Antarctic grounding line. (Auth.)

MP 2059
MODIFIED THEORY OF BOTTOM CREVASSES USED AS A MEANS FOR MEASURING THE BUTTRESSING EFFECT OF ICE SHELVES ON INLAND ICE SHEETS.
Jezek, K.C., *Journal of geophysical research,* Mar. 10, 1984, 89(B3), p.1925-1931, 20 refs.
38-2914
ICE SHELVES, CREVASSES, FLOATING ICE, ICE MECHANICS, ANTARCTICA—ROSS ICE SHELF.

Bottom crevasses are fractures that extend upward into floating ice shelves. They form when seawater penetrates the base of the ice shelf and ruptures the ice up to the level at which englacial stresses equal the stress of the seawater. For a freely floating ice shelf, the penetrating level of closely spaced crevasses is estimated at about half the ice thickness h; for an isolated crevasse the level is about pi h/4. However, an analysis of the heights and locations of bottom crevasses in the Ross Ice Shelf shows that none of the crevasses approach the predicted limits, perhaps because the existing theory does not include the back stress which is present in bounded ice shelves. By reformulating the theory to include a back stress term, back stress can be evaluated experimentally from radar measurements of crevasse height and ice thickness. The magnitude of back stress (2 bars in the grid northwest corner of the ice shelf) suggests the ice shelf is playing an important role in buttressing the inland ice sheet. (Auth.)

MP 2060
WHAT BECOMES OF A WINTER SNOWFLAKE.
Colbeck, S.C., *Weatherwise,* Dec. 1985, 38(6), p.312-215.
40-3481
SNOWFLAKES, SNOW CRYSTAL STRUCTURE, SNOW CRYSTAL GROWTH, TEMPERATURE GRADIENTS, TEMPERATURE EFFECTS, VAPOR DIFFUSION.

MP 2061
SIZE AND SHAPE OF ICE FLOES IN THE BALTIC SEA IN SPRING.
Leppäranta, M., *Geophysica,* 1983, 19(2), p.127-136, 4 refs.
40-3462
ICE FLOES, SEA ICE DISTRIBUTION, REMOTE SENSING, ICE MELTING, AERIAL SURVEYS, SEASONAL VARIATIONS, PHOTOGRAPHY, BALTIC SEA.

MP 2062
ICE PROPERTIES IN THE GREENLAND AND BARENTS SEAS DURING SUMMER.
Overgaard, S., et al, *Journal of glaciology,* 1983, 29(101), p.142-164, With French and German summaries. 34 refs.
Wadhams, P., Leppäranta, M.
37-4260
SEA ICE DISTRIBUTION, ICE COVER STRENGTH, ICE COVER THICKNESS, ICE SALINITY, ICE TEMPERATURE, ICE DENSITY, ICE COMPOSITION, ICE ELECTRICAL PROPERTIES, IONS.

MP 2063
GROWTH MODEL FOR BLACK ICE, SNOW ICE AND SNOW THICKNESS IN SUBARCTIC BASINS.
Leppäranta, M., *Nordic hydrology,* 1983, 14(2), p.59-70, 22 refs.
38-2109
ICE FORMATION, SNOW ICE, SNOW DEPTH, HEAT FLUX, SNOWFALL, SURFACE TEMPERATURE, MATHEMATICAL MODELS, SNOW DENSITY, METAMORPHISM (SNOW), ICE SHEETS.

MP 2064
BURIED SEED AND STANDING VEGETATION IN TWO ADJACENT TUNDRA HABITATS, NORTHERN ALASKA.
Roach, D.A., *Oecologia (Berlin),* 1981, Vol.60, p.359-364, For M.S. thesis see 37-4301. 35 refs.
38-2466
TUNDRA, VEGETATION, GROWTH, SOIL WATER.

MP 2065
UNIFIED DEGREE-DAY METHOD FOR RIVER ICE COVER THICKNESS SIMULATION.
Shen, H.T., et al, *Canadian journal of civil engineering,* Mar. 1985, 12(1), p.54-62, 16 refs.
Yapa, P.D.
39-2513
ICE COVER THICKNESS, RIVER ICE, DEGREE DAYS, ICE CONDITIONS, ICE BREAKUP, MATHEMATICAL MODELS, CANADA—SAINT LAWRENCE RIVER.

MP 2066
ISOTHERMAL COMPRESSIBILITY OF WATER MIXED WITH NA-SATURATED MONTMORILLONITE.
Oliphant, J.L., et al, *Journal of colloid and interface science,* Sep. 1983, 95(1), p.45-50, 14 refs.
Low, P.F.
40-3465
WATER CHEMISTRY, COMPRESSIVE PROPERTIES, CLAYS, FREEZE DRYING, THERMODYNAMICS, MINERALS, ANALYSIS (MATHEMATICS).

MP 2067
CLEAR IMPROVEMENT IN OBSCURATION.
Palmer, R.A., *Military engineer,* Aug. 1985, 77(502), p.476-477.
40-2856
BLOWING SNOW, VISIBILITY, MILITARY OPERATION, FOG, DESIGN.

MP 2068
REPEATED LOAD TRIAXIAL TESTING OF FROZEN AND THAWED SOILS.
Cole, D.M., et al, *Geotechnical testing journal,* Dec. 1985, 8(4), p.166-170, 4 refs.
Durell, G., Chamberlain, E.J.
40-3526
FROZEN GROUND STRENGTH, GROUND THAWING, STRESSES, LOADS (FORCES), THAW WEAKENING, SOIL STRENGTH, FREEZE THAW CYCLES, STRAIN TESTS, DEFORMATION, SOIL WATER, EQUIPMENT.

This paper describes the equipment and methodology used to determine the resilient properties of granular soils that exhibit thaw-weakening behavior. Such soils suffer a significant loss in stiffness as the result of freezing and thawing and subsequently experience an increase in stiffness during a recovery phase. The recovery phase results from gradual desaturation of the thawed soil and is characterized by an increase in the soil moisture tension level. We have developed a means to simulate this freeze-thaw-recovery process in the laboratory that calls for testing specimens several times at soil moisture tension levels corresponding to field observations.

MP 2069
VERTICALLY STABLE BENCHMARKS: A SYNTHESIS OF EXISTING INFORMATION.
Gatto, L.W., U.S. Army Corps of Engineers Surveying Conference, Jacksonville, FL, Feb. 4-8, 1985. Proceedings, 1985, p.179-188, Refs. p.183-185.
40-3527
FROST ACTION, MEASURING INSTRUMENTS, PERMAFROST, BENCH MARKS, TOPOGRAPHIC SURVEYS, HYDROLOGY, STRUCTURES, DEFORMATION, DESIGN.

Techniques used for topographic, hydrographic and structural movement surveys are no more accurate than the benchmarks used as reference. In northern areas, frost action can cause substantial vertical movement of benchmarks. Benchmarks can also subside or shift in wetland and coastal areas. Various benchmark designs and installation procedures reduce or eliminate movement, but information on the designs and procedures is widely scattered and not available to Corps of Engineers Districts in one report. This paper gives the preliminary results of a synthesis of existing information compiled from surveys of Crops of Engineers Districts and Divisions, U.S. and Canadian government agencies and private industry and from a literature review. A matrix for selecting benchmarks appropriate for various climatic and soil conditions will be prepared from the synthesized information. This matrix and a description of the procedures required for installing various types of benchmarks will be available in September 1985.

MP 2070
COLD WEATHER O&M.
Reed, S.C., et al, *Operations forum,* 1985, 2(2), p.10-15, 6 refs.
Niedringhaus, L.
40-3528
WASTE TREATMENT, WATER TREATMENT, COLD WEATHER OPERATION, TEMPERATURE EFFECTS, VISCOSITY, LUBRICANTS.

MP 2071
USACRREL'S SNOW, ICE, AND FROZEN GROUND RESEARCH AT THE SLEEPERS RIVER RESEARCH WATERSHED.
Pangburn, T., et al, Eastern Snow Conference, Washington, D.C., June 7-8, 1984. Proceedings, ₍1984₎, p.229-240, 25 refs.
McKim, H.L.
40-4225
SNOW HYDROLOGY, ICE SURVEYS, FROZEN GROUND PHYSICS, SNOW WATER EQUIVALENT, RUNOFF FORECASTING, WATERSHEDS, MODELS, TEMPERATURE EFFECTS.

The Sleepers River Research Watershed in Danville, Vermont, has one of the longest historical data bases for a cold regions area. NOAA/NWS have been conducting research in snow hydrology at the watershed for the past 24 years; CRREL has been involved for the past 6 years. CRREL's major research involves: 1) developing and testing a sensor that will measure the water equivalent of snow in near real time, and 2) modifying existing hydrologic models to accept remotely obtained data on snow, ice, and frozen ground.

MP 2072

COMPUTATIONAL MECHANICS IN ARCTIC ENGINEERING.

Sodhi, D.S., Computer Methods in Offshore Engineering Specialty Conference, Halifax, Nova Scotia, May 23, 1984. Proceedings, ₍1984₎, p.351-374, Refs. p.367-374.
40-3529
ICE MECHANICS, ICE SOLID INTERFACE, OFFSHORE STRUCTURES, ENGINEERING, ICE LOADS, IMPACT STRENGTH, COLD WEATHER CONSTRUCTION, COMPUTER APPLICATIONS, MATHEMATICAL MODELS, DRIFT, FLOATING ICE.

A review of numerical modeling in arctic engineering is presented, and emphasis is given to the work which deals with computational mechanics. For large-scale problems the dynamic model for sea ice and iceberg drift is discussed. For medium-scale problems the bearing capacity of floating ice sheets and ice-structure interaction for bending, buckling and crushing failures of ice sheets are discussed. A brief discussion is also presented on the impact ice forces and the kinematic model for ridge formation.

MP 2073

TANK E/O SENSOR SYSTEM PERFORMANCE IN WINTER: AN OVERVIEW.

Lacombe, J., et al, Hanover, NH, U.S. Army Cold Regions Research and Engineering Laboratory, ₍1985₎, 26p., Presented at the Smoke/Obscurants Symposium, 9th, Adelphi, MD, April 23-25, 1985. 8 refs.
Redfield, R.K.
40-3530
MILITARY OPERATION, TANKS (COMBAT VEHICLES), COLD WEATHER OPERATION, METEOROLOGICAL FACTORS, LASERS, INSTRUMENTS, WINTER, VISIBILITY, OPTICAL PROPERTIES, ELECTRICAL PROPERTIES, SNOWFALL.

This paper describes the *SNOW-III-WEST* experiment and a related study conducted in the Federal Republic of Germany that was designed to increase the understanding of the effects of winter weather on the performance of electro-optical sensor systems in main battle tanks. SNOW-III-WEST was conducted at Camp Grayling, Michigan, during December 1984 and January 1985. Its objectives were to document the performance of the M1 tank EO sensor suite in winter and gather data from threat vehicle EO sensors and M1 tank developmental sensors for use in developing system capability comparisons. To accomplish this, an M1 tank gunners primary sight (GPS) was positioned to view and range to vehicular targets at distances out to 1600 m. The GPS contains a day sight, nigh sight and laser rangefinder. Other U.S. and threat EO systems were co-located with the GPS. Day and night sight imagery through the device optics was recorded using video equipment while simultaneous target observations by the sight operator were documented. Detailed measurements were made to characterize important target scene and environmental factors. These included: meteorological, airborne-snow, scene illumination, and atmospheric transmission measurements, as well as inherent and apparent visible and infrared target/background signature measurements. *PM Smoke's personnel response* and evaluation system for target obscuration (PRESTO) was used to document the sight operator's target detection responses.

MP 2074

EFFECTS OF SNOW ON VEHICLE-GENERATED SEISMIC SIGNATURES.

Albert, D.G., Sensor Technology Symposium, 4th, Apr. 26-28, 1983. Report. Vol.1: Unclassified papers, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS, Environmental Laboratory, July 1984, p.83-109, 9 refs.
40-3531
SNOW COVER EFFECT, MILITARY OPERATION, SEISMIC SURVEYS, ATTENUATION, ACOUSTICS, SEASONAL VARIATIONS, VEHICLES.

Vehicle-generated seismograms recorded under summer and winter conditions at Fort Devens, Massachusetts, are analyzed and compared. The data were recorded using three-component geophones located just beneath the ground surface and microphones mounted on tripods 0.3 m tall. Winter data were recorded with a 0.7-m-thick snow cover present at the test site. The 14-track FM field tapes were digitized in the laboratory at a sampling rate of 500 Hz in preparation *for filtering and spectral analysis. The filtering effect* of the snow cover on the seismic data is striking. Because the acoustic-to-seismic coupled energy is attenuated by the snow, the appearance and frequency content of the recorded ground motion is changed *dramatically. Automatic vehicle* classification algorithms will have to account for these effects if they are to operate successfully in the presence of snow.

MP 2075

FROZEN PRECIPITATION AND CONCURRENTLY OBSERVED METEOROLOGICAL CONDITIONS.

Bilello, M.A., ₍1985₎, 11p., Presented at the 42nd Meeting of the Eastern Snow Conference, Montreal, Canada, June 1985. 8 refs.
40-3532
SNOWFALL, PRECIPITATION (METEOROLOGY), *METEOROLOGICAL DATA, STATISTICAL* ANALYSIS, FREEZING, AIR TEMPERATURE, HUMIDITY, WIND VELOCITY, FOG, VISIBILITY, DIURNAL VARIATIONS.

This study evaluates statistical data for two or more meteorological parameters, recorded concurrently during the winter. The analysis considers only freezing forms of precipitation, placed into seven categories, and correlated with simultaneously observed atmospheric conditions, such as temperature, humidity and wind speed. Computer tabulated data from 11 years of winter weather for München/Riem, West Germany, were obtained for the investigation. Typical results are: 1) the variations in absolute humidity values that can be expected during periods of fog or ground fog at different air temperatures, 2) the likelihood that freezing rain or freezing drizzle will occur least frequently between 1200 and 1700 hours, and 3) the diurnal and monthly air temperatures, relative humidity and examples of the unusual and interesting environmental knowledge that can be gained from available climatic records; similar investigations can be conducted for other sites that have long-term weather records in computer-based files.

MP 2076

EVALUATION OF SEASONAL VARIATION IN RESILIENT MODULUS OF GRANULAR SOIL AFFECTING PAVEMENT PERFORMANCE.

Johnson, T.C., ₍1985₎, c21p., Presented at the 33rd Annual Conference on Soil Mechanics and Foundation Engineering, St. Paul, MN, Jan. 1985. 27 refs.
40-3533
PAVEMENTS, FREEZE THAW CYCLES, FROZEN GROUND MECHANICS, ROAD MAINTENANCE, SEASONAL VARIATIONS, LOADS (FORCES), DAMAGE, FORECASTING, TESTS, MOISTURE TRANSFER, SOIL STRUCTURE.

MP 2077

MODEL OF 2-DIMENSIONAL FREEZING FRONT MOVEMENT USING THE COMPLEX VARIABLE BE METHOD.

Hromadka, T.V., II, et al, *Microsoftware for engineers,* Oct. 1985, 1(2), 9p., 7 refs.
Berg, R.L.
40-3585
SOIL FREEZING, HEAT TRANSFER, FREEZE THAW CYCLES, BOUNDARY VALUE PROBLEMS, MATHEMATICAL MODELS, SOIL WATER, THERMAL REGIME, COMPUTER APPLICATIONS, LATENT HEAT, PHASE TRANSFORMATIONS, ROADS.

The Complex Variable Boundary Element Method or CVBEM is used to develop a computer model (CVBFR1) for estimating the location of the freezing front in soil-water phase change problems. Because the numerical technique is a boundary integral approach, the control volume thermal regime is modeled with respect to the boundary values and, therefore, the CVBFR1 data entry requirements are significantly less than that usually required of domain methods such as finite-differences or finite-elements. Soil-water phase change along the freezing front is modeled as a simple balance between computed heat flux and the evolution of soil-water volumetric latent heat of *fusion.*

MP 2078

FRAZIL ICE.

Daly, S.F., Conference on Frontiers in Hydraulic Engineering, Cambridge, MA, Aug. 9-12, 1983. Proceedings. Edited by H.T. Shen, New York, American Society of Civil Engineers, 1983, p.218-223, 8 refs.
40-3554
FRAZIL ICE, ICE CRYSTAL GROWTH, ICE STRUCTURE, RIVER ICE, NUCLEATION RATE, STREAMS, ANALYSIS (MATHEMATICS).

The study of crystal growth and its application to large scale industrial crystallization can provide many insights and quantitative approaches to the problem of frazil ice. Number continuity and heat conservation equations are presented in which the key parameters are crystal growth and nucleation rates. These parameters and frazil morphology are discussed. *The problems of applying these equations to natural* waterbodies are discussed. Further research needs are outlined.

MP 2079

UNSTEADY RIVER FLOW BENEATH AN ICE COVER.

Ferrick, M.G., et al, Conference on Frontiers in Hydraulic Engineering, Cambridge, MA, Aug. 9-12, 1983. Proceedings. Edited by H.T. Shen, New York, American Society of Civil Engineers, 1983, p.254-260, 9 refs.
Lemieux, G.E.
40-3560
RIVER FLOW, ICE COVER EFFECT, RIVER ICE, ICE BREAKUP, FRAZIL ICE, FLOODING, ICE JAMS, WATER WAVES, ICE WATER INTERFACE.

MP 2080

FIRST-GENERATION MODEL OF ICE DETERIORATION.

Ashton, G.D., Conference on Frontiers in Hydraulic Engineering, Cambridge, MA, Aug. 9-12, 1983. Proceedings. Edited by H.T. Shen, New York, American Society of Civil Engineers, 1983, p.273-278, 12 refs.
40-3563
ICE DETERIORATION, ICE MODELS, FLOATING ICE, ICE STRUCTURE, RIVER ICE, LAKE ICE, ICE COVER STRENGTH, ICE BREAKUP, HEAT TRANSFER, DIURNAL VARIATIONS.

The phenomenon of deterioration of ice, particularly of floating ice on rivers and lakes, is commonly observed during the spring period. The result of the deterioration is a porous, honeycomb-like structure, generally of low strength, and the greatly reduced strength contributes to the timing of ice break-up as well as significantly reducing the load-carrying *capacity of the ice cover.* A *combined radiation-conduction* heat transfer analysis is presented that predicts the diurnal strength variations associated with low surface albedo and internal melting. The results are compared with field data.

MP 2081

MODELING OF ICE DISCHARGE IN RIVER MODELS.

Calkins, D.J., Conference on Frontiers in Hydraulic Engineering, Cambridge, MA, Aug. 9-12, 1983. Proceedings. Edited by H.T. Shen, New York, American Society of Civil Engineers, 1983, p.285-290, 7 refs.
40-3565
RIVER FLOW, RIVER ICE, ICE MECHANICS, DRIFT, ICE MODELS, HEAT TRANSFER, EXPERIMENTATION, TEMPERATURE EFFECTS, HYDRAULICS, FREEZEUP.

A thermal modeling criterion for the ice discharge in refrigerated physical river models is presented along with laboratory results. Ice production was evaluated for freshwater and *for 0.3% and 1% urea concentrations in water.* Discharges of 0.0056 and 0.0094 cu m/s were run in the model river at air temperatures of 5, 10 and 15C. Preliminary results show that as the concentration of urea in the water is increased, the model ice outflow increases. The measured ice discharge at river outlet and the ice accumulation on the riverbed are both linearly related to the air-water temperature difference. The ice accumulation rate on the riverbed was also found to be a linear function of time. The freshwater flow had a greater bed accumulation rate than urea-doped solutions. A slight increase in model ice production was noted for the higher water flow rates. Proper scaling of the ice discharge through a model reach may require relaxing the heat transfer coefficient scaling law because sufficient ice cannot be generated in the river, and ice must be introduced at the inlet of the model. By changing the urea concentration in the water or using a separate ice production flume, a wide range of values for the input of model ice discharge can be selected.

MP 2082

DYNAMIC FRICTION OF BOBSLED RUNNERS ON ICE.

Huber, N.P., et al, Le sport: Enjeu technologique. Edited by A. Midol and T. Mathia, Dec. 4, 1985, 26p., 10 refs.
Itagaki, K., Kennedy, F.E., Jr.
40-3552
METAL ICE FRICTION, SLEDS, ICE SURFACE, ICE FRICTION, ICE DETERIORATION, DYNAMIC LOADS, MODELS, EXPERIMENTATION, STATISTICAL ANALYSIS.

The challenge we have been presented with, to perfect the runners of the U.S. Bobsled Team's sled for the 1988 Winter Olympics in Calgary, requires an understanding of the experimentation performed by other researchers, the conclusions reached, and the limitations of their findings. Most of the ice friction studies to date have been made under more or less idealized conditions. Thus, in the highly dynamic situation of a bobsled or a skier sliding on a rough ice surface, a variety of unknown and disregarded factors may contribute greatly to the friction phenomena. For instance, none of the previous studies addressed the mechanical destruction of the ice surface, though carving or melting a track *in the ice could account for most of the frictional energy* loss. This paper describes the results of a preliminary study performed using a model sled.

MP 2083

OHIO RIVER MAIN STEM STUDY: THE ROLE OF GEOGRAPHIC INFORMATION SYSTEMS AND REMOTE SENSING IN FLOOD DAMAGE ASSESSMENTS.

Edwardo, H.A., et al, International Symposium on Remote Sensing of Environment, 18th, Paris, France, Oct. 1-5, 1984. Proceedings, Vol.1, [1984], p.265-281, 3 refs.

Merry, C.J., McKim, H.L.

40-3551

REMOTE SENSING, RIVER FLOW, TOPOGRAPHIC FEATURES, FLOODS, DAMAGE, LANDFORMS, GEOGRAPHY, CLASSIFICATIONS, MAPPING, UNITED STATES—OHIO RIVER.

The Pittsburgh District, Corps of Engineers, has conducted feasibility analyses of various procedures for performing flood damage assessments along the main stem of the Ohio River. Procedures using traditional, although highly automated, techniques and those based on geographic information systems have been evaluated at a test site, the City of New Martinsville, Wetzel County, West Virginia. The flood damage assessments of the test site developed from an automated, conventional structure-by-structure appraisal served as the ground truth data set.

MP 2084

SPATIAL ANALYSIS IN RECREATION RESOURCE MANAGEMENT FOR THE BERLIN LAKE RESERVOIR PROJECT.

Edwardo, H.A., et al, 1984 SPOT Symposium. Proceedings. SPOT simulation applications handbook. American Society of Photogrammetry, 1984, p.209-219.

Merry, C.J., McKim, H.L.

40-3550

LANDFORMS, RESERVOIRS, REMOTE SENSING, TOPOGRAPHIC FEATURES, CLASSIFICATIONS, ENVIRONMENT SIMULATION, WATER CHEMISTRY, LAKE WATER, GEOGRAPHY.

The simulated SPOT data acquired from aircraft over the study site had several radiometric characteristics which would not be encountered in the nadir-looking satellite observations. These differential scene brightness features were removed from the data. The corrected data were used in two studies to assess their information content for water quality assessment and land cover classification. Both studies indicate that the SPOT data are comparable to high altitude color-infrared aerial photography in digital form. The implication for land cover mapping is that techniques developed for LANDSAT MSS will need to be modified to allow for interactive user input and the use of textural and contextual features in automatic digital classification. The results of the water quality analysis point to the potential of the SPOT data for assessing the presence of materials in the light-interactive zone of the water column.

MP 2085

WILDLIFE HABITAT MAPPING IN LAC QUI PARLE, MINNESOTA.

Merry, C.J., et al, 1984 SPOT Symposium. Proceedings. SPOT simulation application handbook. American Society of Photogrammetry, 1984, p.205-208.

Green, G., Anderson, S.

40-3549

VEGETATION, REMOTE SENSING, SPECTROSCOPY, PHOTOINTERPRETATION, MAPPING, CLASSIFICATIONS, AGRICULTURE, UNITED STATES—MINNESOTA—LAC QUI PARLE.

SPOT High Resolution Visible (HRV) simulated data were obtained over Lac qui Parle, Minnesota, to determine their usefulness for mapping wildlife habitat categories associated with Corps projects. Ground truth data were available from photointerpreted wildlife habitat unit maps and the agricultural crop inventory prepared for the summer of 1983. A geometric correction could not be applied to the data set, so only the spectral reflectance quality of the data was assessed. The sample size of 512 x 512 pixels was selected for the analyses. An unsupervised classification land cover map was generated with the Earth Resources Laboratory Application Software package. The classification was successful in discriminating wheat and alfalfa and other uniformly colored areas, but pasture and corn could not be separated. Also, we were not successful in separation of grasslands and legumes. Our results indicated that the 20-m HRV data can be used to photointerpret wildlife habitat using the false color image, but a digital classification cannot be performed. To obtain a habitat map using the HRV data would require a multitemporal analysis.

MP 2086

CRREL INVESTIGATIONS RELEVANT TO OFFSHORE PETROLEUM PRODUCTION IN ICE-COVERED WATERS.

Tucker, W.B., International Symposium on Remote Sensing of Environment. Second Thematic Conference "Remote Sensing for Exploration Geology," Fort Worth, Texas, Dec. 6-10, 1982, Proceedings. Vol.1, [1983], p.207-215, Refs. p.213-215.

40-3547

OFFSHORE STRUCTURES, ICE LOADS, SEA ICE DISTRIBUTION, REMOTE SENSING, DRIFT, ICE CONDITIONS, ICE CRYSTAL STRUCTURE, DESIGN, ICE MECHANICS, ICE STRENGTH.

The U.S. Army Cold Regions Research and Engineering Laboratory has studied the sea ice environment of the Beaufort Sea for many years. Offshore development is now proceeding beyond the barrier islands and many of these studies have relevance to the planned activities. Sea ice presents a formidable hazard to the design and construction of production platforms and sea floor pipelines. CRREL investigations have addressed a number of the problems associated with these activities and remote sensing has played a major role in some of these studies. Specific efforts at CRREL have addressed the measurement of ice motion, the distribution and morphology of pressure ridges and shore ice pile-ups, ice conditions and thickness, the determination of ice strength, ice crystal structure, and the modeling of ice dynamics and thermodynamics.

MP 2087

ICE BANDS IN TURBULENT PIPE FLOW.

Ashton, G.D., *American Society of Mechanical Engineers. Winter annual meeting. Heat Transfer Division. Pamphlet paper*, 1984, 84-WA/HT-106, 7p., 10 refs.

40-3584

PIPELINE FREEZING, PIPE FLOW, ICE FORMATION, HEAT TRANSFER, ICE SURFACE, TURBULENT FLOW, HEAT FLUX, FLOW RATE, EXPERIMENTATION, SURFACE ROUGHNESS.

Results of experiments in two pipe sizes with annular freezing are reported. A wavy ice relief generally formed. The results are compared to a correlation previously proposed by Gilpin based on a thermal criterion and to a correlation developed by Ashton based on a kinematic criterion. The results are discussed within the context of these criteria.

MP 2088

ICE ENGINEERING FACILITY.

Zabilansky, L.J., et al, [1983], 12p. + fig., Prepared for the International Institute of Ammonia Refrigeration, 5th annual meeting, Sarasota, FL, April 17-20, 1983.

Alexander, V.

40-3609

ICE SURVEYS, LABORATORIES, EQUIPMENT, ICE NAVIGATION, ICE FORMATION, ICE LOADS, ICE JAMS, ENGINEERING, ICING, FLOODS, HEAT RECOVERY.

MP 2089

DATA ACQUISITION IN USACRREL'S FLUME FACILITY.

Daly, S.F., et al, Specialty Conference on Hydraulics and Hydrology in the Small Computer Age, Lake Buena Vista, FL, Aug. 12-17, 1985. Proceedings, Vol.2. Edited by W.R. Waldrop, New York, American Society of Civil Engineers, 1985, p.1053-1058, 1 ref.

Wuebben, J.L., Zabilansky, L.J.

40-3610

LABORATORIES, COMPUTER APPLICATIONS, REFRIGERATION, ICE FORMATION, HYDRAULICS, SEDIMENT TRANSPORT, FRAZIL ICE, UNSTEADY FLOW, ICE COVER EFFECT, EQUIPMENT.

The refigerated flume facility at the U.S. Army Cold Regions Research and Engineering Laboratory (USACRREL), Hanover, New Hampshire, consists of a tiltable flume that is 120 ft long, 4 ft wide and 2 ft deep (36.6 x 1.2 x 0.61 m), two constant-speed centrifugal pumps and associated piping, flow meters, heat transfer devices, automatic valves, etc. The flume is an experimental facility used to study the formation of frazil ice, temperature effects on sediment transport, unsteady flow under an ice cover, and other subjects relevant to cold regions hydraulics. A computerized data acquisition system has been developed that is based on a Hewlett-Packard 9845B desktop computer.

MP 2090

CAZENOVIA CREEK MODEL DATA ACQUISITION SYSTEM.

Bennett, B.M., et al, Specialty Conference on Hydraulics and Hydrology in the Small Computer Age, Lake Buena Vista, FL, Aug. 12-17, 1985. Proceedings, Vol.2. Edited by W.R. Waldrop, New York, American Society of Civil Engineers, 1985, p.1424-1429, 4 refs.

Zabilansky, L.J.

40-3611

MODELS, ICE BREAKUP, COMPUTER APPLICATIONS, RIVER ICE, ICE CONTROL, ICE JAMS, TESTS, ENGINEERING, STRUCTURES, DESIGN, COUNTERMEASURES.

The Cazenovia Creek Model is a physical hydraulic model constructed in the 160-ft x 80-ft (48.8-m x 24.4-m) refrigerated research area of the Ice Engineering Facility at the U.S. Army Cold Regions Research and Engineering Laboratory located in Hanover, New Hampshire. The purpose of the model is to reproduce river ice breakup phenomena for optimizing the design of an ice control structure. The optimal design will delay or ultimately prevent the passage of ice floes, eliminating downstream ice jam flooding. The performance of the ice control structure during a simulated breakup is monitored by using an interactive real-time data acquisition system. The data acquisition system is governed by a Hewlett-Packard 9845A desktop computer and enables a rapid analysis of the work because of the real-time monitoring. This paper discusses the model and its method of data collection.

MP 2091

INSTRUMENTATION FOR AN UPLIFTING ICE FORCE MODEL.

Zabilansky, L.J., Specialty Conference on Hydraulics and Hydrology in the Small Computer Age, Lake Buena Vista, FL, Aug. 12-17, 1985. Proceedings, Vol.2. Edited by W.R. Waldrop, New York, American Society of Civil Engineers, 1985, p.1430-1435, 4 refs.

40-3612

MODELS, OFFSHORE STRUCTURES, COMPUTER APPLICATIONS, FREEZEUP, ICE PRESSURE, ICE LOADS, ENGINEERING, WATER LEVEL, PILE STRUCTURES.

Marine structures frozen into an ice cover are subjected to vertical forces as the ice sheet responds to changes in the water level. Pile-supported, light duty structures are especially vulnerable to the uplifting forces, which can extract the piles from the soil, destroying the structure's integrity. To evaluate the parameters that control the magnitude of the uplifting force a laboratory model study was conducted in a refrigerated test basin.

MP 2092

REAL-TIME MEASUREMENTS OF UPLIFTING ICE FORCES.

Zabilansky, L.J., *Instrumentation in the aerospace industry*, 1985, Vol.31, p.253-259, 2 refs.

40-3638

ICE SOLID INTERFACE, PILE EXTRACTION, ICE LOADS, PILE LOAD TESTS, OFFSHORE STRUCTURES, DAMAGE, COUNTERMEASURES, COMPUTER APPLICATIONS.

MP 2093

BOUNDARY INTEGRAL EQUATION SOLUTION OF MOVING BOUNDARY PHASE CHANGE PROBLEMS.

O'Neill, K., *International journal for numerical methods in engineering*, 1983, Vol.19, p.1825-1850, 47 refs.

40-3660

SOIL FREEZING, ANALYSIS (MATHEMATICS), BOUNDARY VALUE PROBLEMS, PHASE TRANSFORMATIONS, CONVECTION, STEFAN PROBLEM, TEMPERATURE GRADIENTS, PIPES (TUBES).

Boundary integral equation methods are presented for the solution of some two-dimensional phase change problems. Convection may enter through boundary conditions, but cannot be considered within phase boundaries. A general formulation based on space-time Green's fucntions is developed using the complete heat equation, followed by a simpler formulation using the Laplace equation. The latter is pursued and applied in detail. An elementary, noniterative system is constructed, featuring linear interpolation over elements on a polygonal boundary. Nodal values of the temperature gradient normal to a phase change boundary are produced directly in the numerical solution. The system performs well against basic analytical solutions, using these values in the interphase jump condition, with the simplest formulation of the surface normal at boundary vertices. Because the discretized surface changes automatically to fit the scale of the problem, the method appears to offer many of the advantages of moving mesh finite element methods. However, it only requires the manipulation of a surface mesh and solution for surface variables. In some applications, coarse meshes and very large time steps may be used, relative to those which would be required by fixed grid domain methods. Computations are also compared to original lab data, describing two-dimensional soil freezing with a time-dependent boundary condition. Agreement between simulated and measured histories is good.

MP 2094

HELICOPTER SNOW OBSCURATION SUBTEST.

Ebersole, J.F., *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* June 1984, SR 84-20, SNOW-TWO data report. Vol.2: System performance. Edited by R. Jordan, p.359-376, ADB-101 241.

40-3784

MILITARY OPERATION, HELICOPTERS, NAVIGATION, BLOWING SNOW, SNOW COVER EFFECT, PHOTOGRAPHY, AIR CUSHION VEHICLES, DETECTION, COUNTERMEASURES, TESTS.

Three sets of helicopter-downwash-produced snow obscuration trials were conducted (two sets on 8 December 1983, one set on 17 January 1984), for a total of 30 individual trials. Both hovering and forward flight patterns were performed. In order to obtain an adequate data base which is relevant to Army scenarios, the planned flight altitudes chosen for the test were for representative flying at low-level or NOE (nap-of-earth) missions and landing. In addition, some test flight trials were directed towards information on "masking" and "unmasking" below and above terrain features or tree tops. Thus the altitudes for the test were primarily restricted to no higher than 50 feet above the surface for forward flights, and 150 feet for hovering. Flights were made perpendicular to the main transmissometer line of sight, or in hovering, vertical take-off and landing modes.

MP 2095

SNOW-COVER CHARACTERIZATION: SADARM SUPPORT.

O'Brien, H., et al, *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* June 1984, SR 84-20, SNOW-TWO data report. Vol.2: System performance. Edited by R. Jordan, p.409-411, ADB-101 241.

Bates, R.

40-3787

SNOW OPTICS, SNOW ELECTRICAL PROPERTIES, MILITARY OPERATION, METEOROLOGICAL FACTORS, SNOW COVER EFFECT, DETECTION, SNOW DENSITY, SNOW WATER CONTENT, GRAIN SIZE, SNOW DEPTH.

MP 2096

FIELD SAMPLING OF SNOW FOR CHEMICAL OBSCURANTS AT SNOW-TWO/SMOKE WEEK VI.

Cragin, J.H., *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* June 1984, SR 84-20, SNOW-TWO data report. Vol.2: System performance. Edited by R. Jordan, p.265-270, ADB-101 241, 3 refs.

40-3782

MILITARY OPERATION, SMOKE GENERATORS, SNOW COMPOSITION, SNOWFALL, SNOW SURFACE, VISIBILITY, CHEMICAL ANALYSIS, AIR POLLUTION, TESTS.

MP 2097

TERRAIN ANALYSIS FROM SPACE SHUTTLE PHOTOGRAPHS OF TIBET.

Kreig, R.A., et al, International Conference on Cold Regions Engineering, 4th, Anchorage, Alaska, Feb. 24-26, 1986. Proceedings. Edited by W.L. Ryan, New York, American Society of Civil Engineers, 1986, p.400-409, 14 refs.

Guodong, C., Brown, J.

40-2459

PERMAFROST DISTRIBUTION, ALPINE LANDSCAPES, REMOTE SENSING, TOPOGRAPHIC FEATURES, CONTINUOUS PERMAFROST, MAPPING, SPACEBORNE PHOTOGRAPHY, AERIAL SURVEYS, TIBET.

MP 2098

EFFECT AND DISPOSITION OF TNT IN A TERRESTRIAL PLANT.

Palazzo, A.J., et al, *Journal of environmental quality,* Jan.-Mar. 1986, 15(1), p.49-52, 24 refs.

Leggett, D.C.

40-3708

SOIL POLLUTION, PLANT PHYSIOLOGY, VEGETATION, MILITARY FACILITIES, ROOTS, DAMAGE, WASTE DISPOSAL, WATER TREATMENT.

Little is known about the response of terrestrial plants to 2,4,6-trinitrotoluene (TNT). To assess its effects, yellow nutsedge *(Cyperus esculentus* L.) was grown in hydroponic cultures containing TNT concentrations of 0, 10, and 20 mg/L. The deleterious effects of TNT were rapid and occurred at solution concentrations of 5 mg/L and higher. Root growth was most affected, followed by leaves and rhizomes. Root weights were reduced about 95% when grown in the presence of TNT. Plant yields were 54 to 74% lower than the control. The TNT and its metabolites, 4-amino-2,6-dinitrotoluene (4-ADNT), and 2-amino-4,6-dinitrotoluene (2-ADNT) were found throughout the plants. Solutions were continually monitored to ensure that no metabolites were present in solution. Since TNT was the only compound taken up, the metabolites must have formed within the plant. Levels of 4-ADNT exceeded those of 2-ADNT and TNT itself, ranging up to 2200 mg/kg in roots of plants grown in 20 mg/L of TNT. The greatest quantities of all three compounds were found in the rhizomes. Increasing solution TNT levels increased the concentrations and quantities of all three compounds in the plants.

MP 2099

METEOROLOGICAL VARIATION OF ATMOSPHERIC OPTICAL PROPERTIES IN AN ANTARCTIC STORM.

Egan, W.G., et al, *Applied optics,* Apr. 1, 1986, 25(7), p.1155-1165, 56 refs.

Hogan, A.W.

40-3771

REMOTE SENSING, BLOWING SNOW, ALBEDO, VISIBILITY, AEROSOLS, SOLAR RADIATION, ANTARCTICA—AMUNDSEN-SCOTT STATION.

Ground truth inputs obtained during an antarctic storm were applied to the Dave vector atmospheric model. The spectropolarimetric properties of upwelling atmospheric radiation are quantitatively related to the number of ice crystals in the optical path. At large scattering angles (smaller angles in the plane of vision), the ice crystal scattering produces strong polarization proportional to the concentration. However, at small scattering angles, the ice crystals cause generally small polarization, permitting the generally large polarization properties of the underlying terrestrial surface to be inferred. Ice crystals, by virtue of their edges, scatter differently than spheres and may have scattering cross sections many orders of magnitude greater than an equivalent area sphere. Polarization appears to be a useful adjunct in synoptic passive atmospheric remote sensing. (Auth.)

MP 2100

FINITE ELEMENT SIMULATION OF ICE CRYSTAL GROWTH IN SUBCOOLED SODIUM-CHLORIDE SOLUTIONS.

Sullivan, J.M., Jr., et al, International Conference on Numerical Methods in Engineering: Theory and Applications (NUMETA 85), Swansea, Wales, Jan. 7-11, 1985. Proceedings, Vol.1. Edited by J. Middleton and G.N. Pande, Rotterdam, A.A. Balkema, 1985, p.527-532, 12 refs.

Lynch, D.R., O'Neill, K.

40-3850

ICE CRYSTAL GROWTH, SOLUTIONS, TEMPERATURE EFFECTS, FREEZING, DENDRITIC ICE, ANALYSIS (MATHEMATICS).

A finite element solution for ice-crystal growth in subcooled sodium-chloride solution is presented. The freezing process for aqueous solutions requires simultaneous solution of the heat equation in the solid and a complete transport treatment in the liquid region. The moving ice surface in the simulations is continuously tracked via deformable grids. Heat and mass are conserved exactly in the simulations. Specifying the interface temperature based on the constitutional phase diagram is inadequate due to the disparate interfacial growth kinetics for the A-axis and C-axis of the ice crystal. Herein we apply radiation type boundary conditions on the ice interface which maintain temperature close to equilibrium along a fast-growth axis, but allow subcooled conditions to prevail along a slow-growth axis. This preliminary report concentrates on problem formulation and one-dimensional verification of the method against analytic solutions.

MP 2101

PERFORMANCE BASED TIRE SPECIFICATION SYSTEM FOR MILITARY WHEELED VEHICLES.

Blaisdell, G.L., U.S. Army Survivable Tire Symposium, Carson City, NV, Nov. 4-8, 1985. Proceedings, [1985], p.277-280, 2 refs.

40-3884

TIRES, MILITARY EQUIPMENT, VEHICLES, DESIGN.

Most military wheeled vehicles continue to utilize the NDCC tire, despite its extremely low tread life and relatively poor performance. Current tire technology has far surpassed that available when the NDCC tire was designed, yet the Army continues, on all but its newest vehicles, to apply this tire. With such a disparity between the NDCC tire and what is commercially available, and with the potential now to design a tire for numerous specific performance areas, how does the Army determine what tire it should use for a particular vehicle? In answering this question, a working group was formed, and a new tire specification was developed. This system is based not on specific design features in as much as is possible, but on critical areas of tire performance. This system takes into account the vehicle's mission profile and the necessity of certain minimum levels of performance for various conditions.

MP 2102

RADIAL TIRE DEMONSTRATION.

Liston, R.A., U.S. Army Survivable Tire Sympoaium, Carson City, NV, Nov. 4-7, 1985. Proceedings. [1985], p.281-285.

40-3866

TIRES, MILITARY EQUIPMENT, MILITARY TRANSPORTATION, VEHICLES.

A demonstration of the use of commercially available radial tires on the Army's 5 ton dump truck is currently in progress at Wildflecken, Germany. One construction company, Company C of the 54th Engineering Battalion, has approximately half of its trucks equipped with radial tires and half with the standard military tires. The purpose of the demonstration is to identify the improved off-road, highway, and tread wear performance of the commercial radial tire compared to the bias ply, non-directional cross country tire that has been the US Army standard tire for some forty years. Some information relative to fuel usage and rolling resistance are provided.

MP 2103

TIME-LAPSE THERMOGRAPHY: A UNIQUE ELECTRONIC IMAGING APPLICATION.

Marshall, S.J., et al, International Electronic Imaging Exposition and Conference, Boston, MA, Sep. 11-13, 1984, [1984], p.84-88, 21 refs.

Munis, R.H.

40-4226

SURFACE TEMPERATURE, INFRARED PHOTOGRAPHY, ELECTRONIC EQUIPMENT, LASERS.

A new technique has been recently introduced that combines time-lapse video techniques with those of thermal imaging. As a result, dynamic thermal events can be recorded in fast or slow motion and played back at expanded or compressed rates compatible with digital enhancement and analysis techniques. The enhancement techniques are used to improve the capability for pattern recognition as well as for the rapid extraction of maximum, minimum and average surface temperatures. The equipment necessary to assemble and operate a typical time-lapse thermal imaging system is described along with some examples of practical and research applications. The capabilities, limitations, and future possibilities are also discussed.

MP 2104

SIMPLE MODEL OF ICE SEGREGATION USING AN ANALYTIC FUNCTION TO MODEL HEAT AND SOIL-WATER FLOW.

Hromadka, T.V., II, et al, International Offshore Mechanics and Arctic Engineering Symposium, 3rd, New Orleans, Louisiana, Feb. 12-17, 1984. Proceedings, Vol.3. Edited by V.J. Lunardini, New York, American Society of Mechanical Engineers, 1984, p.99-104, 10 refs.

Guymon, G.L.

38-2031

FROST HEAVE, SOIL FREEZING, HEAT TRANSFER, MOISTURE TRANSFER, FREEZE THAW CYCLES, GROUND ICE, SOIL WATER MIGRATION, HYDRAULICS, WATER PRESSURE, MATHEMATICAL MODELS.

MP 2105

PROCEEDINGS.

International Offshore Mechanics and Arctic Engineering Symposium, 4th, Dallas, Texas, Feb. 17-21, 1985, New York, American Society of Mechanical Engineers, 1985, 2 vols., Refs. passim. For selected papers see 39-2382 through 39-2438.

Chung, J.S., ed, Lunardini, V.J., ed.

39-2381

OFFSHORE STRUCTURES, OFFSHORE DRILLING, ICE CONDITIONS, ICE LOADS, IMPACT STRENGTH, ENGINEERING, CONSTRUCTION MATERIALS, OCEANOGRAPHY, MEETINGS.

MP 2106

ICE GOUGE HAZARD ANALYSIS.

Lanan, G.A., et al, Offshore Technology Conference, 18th, Houston, Texas, May 5-8, 1986. Proceedings, Vol.4, 1986, p.57-66, 13 refs.

Niedoroda, A.W., Weeks, W.F.

40-3880

ICE SCORING, TRENCHING, OCEAN BOTTOM, PIPELINES, MARINE GEOLOGY.

Sea floor ice gouge depth distributions and pipeline trenching requirements are analyzed. An improved method is presented for parameterizing new ice gouge events based on a single record of existing sea floor ice gouges. Information on the gouge infilling process and the maximum observable gouge depth are used in this procedure.

MP 2107

RELIABLE, INEXPENSIVE RADIO TELEMETRY SYSTEM FOR THE TRANSFER OF METEOROLOGICAL AND ATMOSPHERIC DATA FROM MOUNTAIN-TOP SITES.

Govoni, J.W., et al, International Workshop on Atmospheric Icing of Structures, 3rd, Vancouver, B.C., May 6-8, 1986. Proceedings, Canadian Electrical Association, [1986], 6p., (4.2). 6 refs.

Rancourt, K.L., Oxton, A.

40-3967

POWER LINE ICING, ICING, RADIO COMMUNICATION, TELECOMMUNICATION, ICE ACCRETION, STRUCTURES, MOUNTAINS, METEOROLOGICAL DATA, WIND VELOCITY, WIND DIRECTION, PRECIPITATION (METEOROLOGY), COMPUTER APPLICATIONS.

A study to examine orographic effects on atmospheric icing intensity is being conducted on two remote mountaintops in the northeastern United States. The study involves the collection and transmission of meteorological data, including wind speed and direction, precipitation, humidity, temperature, and icing rate. Remote sites are located on Loon Mountain and Cannon Mountain, both situated in the White Mountains of New Hampshire. State-of-the-art instrumentation, consisting of hot cross wire wind sensors, humidity probes, ice detectors and electronic rain gauges, is interfaced with on-site data loggers. The data are transmitted from these remote sites by a specially designed radio telemetry system, consisting of a Tucson Amateur Packet Radio Terminal Node Controller (TNC) and a Motorola radio link.

MP 2108

CONDUCTOR TWISTING RESISTANCE EFFECTS ON ICE BUILD-UP AND ICE SHEDDING.

Govoni, J.W., et al, International Workshop on Atmospheric Icing of Structures, 3rd, Vancouver, B.C., May 6-8, 1986. Proceedings, Canadian Electrical Association, [1986], 8p. + figs., (5.8). 5 refs.

Ackley, S.F.

40-3983

ICING, ICE REMOVAL, CABLES (ROPES), ICE BREAKING, WIND VELOCITY, EXPERIMENTATION.

Two wires of similar diameter (about 1 cm) but with different twisting resistance or torsional rigidity were tested under otherwise similar environmental icing conditions at the summit of Mt. Washington. It was found that the more rotationally rigid (stiffer) wire affected both the mode of ice buildup and showed some capability of deicing itself in moderate wind conditions. The lesser ice buildup on the stiffer wire is apparently related to the suppression of dynamic twisting oscillations in the wire, oscillations which were apparent in the softer wire. The softer wire showed heavier ice buildup with the wire at the center of a cylindrical accretion. The stiff wire showed less ice buildup on the windward side with the development of an elliptical accretion due to semi-static rotation of the wire. Deicing of the stiffer wire apparently took place by breaking of the ice after it slowly rotated into the wind by several possible mechanisms. The increased drag on the ice as it moved into the wind creates a bending moment which apparently exceeded the failure stress of the ice near where it was attached to the wire. The ice fails and drops off the wire and the cycle then repeats itself.

MP 2109

COMMUNICATION TOWER ICING IN THE NEW ENGLAND REGION.

Mulherin, N., et al, International Workshop on Atmospheric Icing of Structures, 3rd, Vancouver, B.C., May 6-8, 1986. Proceedings, Canadian Electrical Association, [1986], 7p., (6.9). 15 refs.

Ackley, S.F.

40-3991

ICING, TOWERS, HOARFROST, TRANSMISSION LINES, PRECIPITATION (METEOROLOGY), DAMAGE, COST ANALYSIS.

Rime icing and freezing precipitation are of concern to the radio and television broadcasting industry. This paper discusses the results of a study seeking to document the severity and extent of transmitter tower icing and related problems in the northeastern United States. Information was obtained via mail questionnaire and telephone interviews with eighty-five station owners and engineers concerning 118 different stations. Results show that television and FM broadcasters are seriously impacted, yet AM operators are, in general, only slightly affected by expected New England icing levels. Combined annual costs for icing protection and icing related repairs averaged $121, $402, and $3066 for AM, FM, and TV stations, respectively. None of the AM stations polled employ any icing protection measures, whereas all the TV stations do.

MP 2110

STRUCTURE OF ICE IN THE CENTRAL PART OF THE ROSS ICE SHELF, ANTARCTICA.

Zotikov, I.A., et al, *Akademiia nauk SSSR. Institut geografii. Materialy gliatsiologicheskikh issledovanii, 1985, No.54, p.39-44, 8 refs.*, In Russian with English summary.

Gow, A.J., Jacobs, S.S.

40-3903

ICE SHELVES, ICE COMPOSITION, ICE CORES, ICE CRYSTALS, IMPURITIES, CLIMATIC CHANGES.

Studies of ice cores, obtained from a 416 m. deep borehole in the Ross Ice Shelf in the vicinity of the J-9 station, revealed changes in ice crystal structure, inclusions and dimensions with depth. This variation is explained by climatic fluctuations.

MP 2111

TOXIC ORGANICS REMOVAL KINETICS IN OVERLAND FLOW LAND TREATMENT.

Jenkins, T.F., et al, *Water research*, 1985, 19(6), p.707-718, 32 refs.

Leggett, D.C., Parker, L.V., Oliphant, J.L.

40-3900

WASTE TREATMENT, WATER TREATMENT, WATER POLLUTION, LAND RECLAMATION, VEGETATION, EXPERIMENTATION, MODELS.

The efficiency in removing 13 trace organics from wastewater was studied on an outdoor, prototype overland flow land treatment system. More than 94% of each substance was removed at an application rate of 0.4 cm/h (0.12 cu m/h/m of width). The % removals declined as application rates were increased. Removal from solution was described by first-order kinetics. A model based on the two-film theory was developed using three properties of each substance (the Henry's constant, the octanol-water partition coefficient and the molecular weight) and two system parameters (waverage water depth and residence time). The dependence of the removal process on temperature was consistent with the known dependence of Henry's constant and diffusivity on temperature. The model was tested on a second overland flow system.

MP 2112

WASTEWATER TREATMENT AND REUSE PROCESS FOR COLD REGIONS.

Bouzoun, J.R., Cold Regions Environmental Engineering Conference, Fairbanks, AK, May 18-23, 1983. Edited by T. Tilsworth and D.W. Smith, [1983], p.547-557, 11 refs.

40-3993

WASTE TREATMENT, WATER TREATMENT, SLUDGES, LAND RECLAMATION, DESIGN.

MP 2113

REVEGETATION ALONG PIPELINE RIGHTS-OF-WAY IN ALASKA.

Johnson, L., International Symposium on Environmental Concerns in Rights-of-Way Management, 3rd, San Diego, CA, Feb. 15-18, 1982. Proceedings, State College, Mississippi State University, 1984, p.254-264, 12 refs.

40-3994

REVEGETATION, VEGETATION, PIPELINES, INTRODUCED PLANTS, GRASSES, UNITED STATES—ALASKA.

The Trans-Alaska Pipeline System for transporting crude oil from Prudhoe Bay to Valdez has recently been completed. The Alaskan Natural Gas Transportation System for transporting gas from Prudhoe Bay to the "Lower 48" is under construction. The rights-of-way of both these major pipelines traverse the arctic and subarctic climatic zones, where severe environmental conditions require specialized measures for revegetating disturbed terrain. On the oil pipeline right-of-way an aggressive grass seeding and fertilizing program was used for revegetation, while on the natural gas pipeline natural reinvasion will be encouraged. These different approaches reflect different management goals and changing technologies as revegetation research progresses in the far north. This paper presents some of the implications of these methods for long-term restoration of disturbed terrestrial areas.

MP 2114

COMBINED ICING AND WIND LOADS ON A SIMULATED POWER LINE TEST SPAN.

Govoni, J.W., et al, International Workshop on Atmospheric Icing of Structures, Trondheim, Norway, June 19-21, 1984. Proceedings, [1984], 7p., 3 refs.

Ackley, S.F.

40-3995

POWER LINE ICING, ICE LOADS, ICE ACCRETION, WIND PRESSURE, UNFROZEN WATER CONTENT, SUPERCOOLED CLOUDS, WIND VELOCITY, TESTS.

During the winter of 1982-83 measurements of combined icing and wind loading, along with in-cloud liquid water content and droplet size, were obtained on a simulated power line test span at the 2000-meter summit of Mt. Washington, New Hampshire. Icing loads were measured using a triaxial load cell which resolves three perpendicular force components of the wire tension. Wind speeds were obtained from a vaned pitot-static tube located near one end of the test wire. Wind and gravity loading of the test span was obtained for winds up to 80 m/s. The in-line loading, a combination of wind and gravity loads, ranged up to 2300 N for ice accretions of up to 19 cm in diameter. Some indications were found that rougher rime ice accretions had higher drag than glaze accretions.

MP 2115

MEASURED AND EXPECTED R-VALUES OF 19 BUILDING ENVELOPES.

Flanders, S.N., *ASHRAE transactions*, 1985, 91(2B), p.49-57, 3 refs.

40-3992

BUILDINGS, THERMAL INSULATION, HEAT TRANSFER, WALLS, HEAT FLUX, MANUALS, ROOFS, COLD WEATHER CONSTRUCTION.

This paper compares *in situ* measurements of R-values R(e) with R-values obtained from handbook calculations for 19 Army buildings in Colorado, Washington, and Alaska. The R-values were measured with heat flux and temperature sensors, with data averaged and recorded for several days. The handbook calculations rely on borings in the construction, depth probes, boroscope inspection, and as-built drawings. A subjective measure of certainty about the construction reflects the quality of this information. Examination of selected study cases indicated that convection is a frequent heat transfer mechanism in fibrous insulation, in both walls and attics. Thermal bridges were also evident from the measurements. Air leakage and moisture were not significant causes of (delta)R. Measurements of R-values were found to be in good agreement with handbook values, where knowledge of the construction is good and where convection and thermal bridges are not major effects.

MP 2116

HYDROLOGIC ASPECTS OF ICE JAMS.

Calkins, D.J., Symposium: Cold Regions Hydrology, Fairbanks, Alaska, [1986]. Proceedings. Edited by D.L. Kane, Bethesda, MD, American Water Resources Association, 1986, p.603-609, 14 refs.

40-4097

ICE JAMS, HYDROLOGY, RIVER ICE, SNOWMELT, THERMAL ANALYSIS, RIVER FLOW.

The hydrologic aspects of ice jams have received very little attention. This paper examines hydrologic information that is important for analyzing ice jam flooding problems, such as flow measurements under the ice cover and winter stage rating curves, frequency analysis of winter flow records, watershed cooling and natural river thermal regimes, ice discharge and snowmelt runoff prediction. The significance of each of these areas is addressed and suggested research opportunities are examined. During the last 30 years, the major emphasis has been placed on understanding the hydraulics and mechanics of ice jams and determining their "flood" levels. However, a parameter that should be known with reasonable accuracy is the flow discharge at the ice jam location.

MP 2117

REMOTE SENSING OF THE ARCTIC SEAS.

Weeks, W.F., et al, *Oceanus*, 1986, 29(1), p.59-64, 7 refs.

Carsey, F.D.

40-4196

SEA ICE DISTRIBUTION, ICE CONDITIONS, REMOTE SENSING, MICROWAVES, ICE MECHANICS, ICE COVER THICKNESS, RADIATION BALANCE, AIR TEMPERATURE, ARCTIC OCEAN.

MP 2118

ORIENTATION TEXTURES IN ICE SHEETS OF QUIETLY FROZEN LAKES.

Gow, A.J., *Journal of crystal growth*, Feb.-Mar. 1986, 74(2), p.247-258, 19 refs.

40-4118

ICE CRYSTAL STRUCTURE, LAKE ICE.

MP 2119

ARCTIC ICE AND DRILLING STRUCTURES.

Sodhi, D.S., *Mechanical engineering*, Apr. 1985, 107(4), p.63-69.

40-4162

OFFSHORE STRUCTURES, DRILLING, ICE LOADS.

MP 2120

ST. LAWRENCE RIVER FREEZE-UP FORECAST.

Foltyn, E.P., et al, *Journal of waterway, port, coastal and ocean engineering*, July 1986, 112(4), p.467-481, 16 refs.

Shen, H.T.

40-4246

ICEBOUND RIVERS, ICE FORECASTING, RIVER ICE, FREEZEUP, ICE FORMATION, LONG RANGE FORECASTING, ANALYSIS (MATHEMATICS), AIR TEMPERATURE, WATER TEMPERATURE, SAINT LAWRENCE RIVER.

In this study a method for making long-range forecasts of freeze-up dates in rivers is developed. The method requires the initial water temperature at an upstream station, the long-range air temperature forecast, the predicted mean flow velocity in the river reach, and water temperature response parameters. The water temperature response parameters can be either estimated from the surface heat exchange coefficient and the average flow depth or determined empirically from recorded air and water temperature data. The method is applied to the St. Lawrence River between Kingston, Ontario, and Massena, New York, and is shown to be capable of forecasting the freeze-up data.

MP 2121

VARIATION OF ICE STRENGTH WITHIN AND BETWEEN MULTIYEAR PRESSURE RIDGES IN THE BEAUFORT SEA.

Weeks, W.F., *Journal of energy resources technology,* June 1985, 107(2), p.167-172, 6 refs. For another source see 38-2036 (MP 1680).
39-3284

ICE STRENGTH, PRESSURE RIDGES, COMPRESSIVE PROPERTIES, POROSITY, TESTS.

A recent series of tests on the uniaxial compressive strength of ice samples taken from multiyear pressure ridges allows the testing of several hypotheses concerning the variation in strength within and between ridges. The data set consists of 218 strength tests performed at two temperatures (-5 and -20 C) and two strain rates (.001 and .00005/s). There was no significant difference between the strength of the ice from the ridge sails and the ice from the ridge keels when tested under identical conditions. As the total porosity of the ice from the sails is higher by 40 percent than the ice from the keels, the lack of a significant difference is believed to result from the large variations in the structure of the ice which occur randomly throughout the cores. A three-level analysis of variance model was used to study the variations in strength between 10 different ridges, between cores located side by side in a given ridge, and between samples from the same core. In all cases the main factor contributing to the observed variance was the differences within cores. This is not surprising considering the rather extreme local variability in the structure of ice in such ridges. There was no reason at the 5 percent level of significance to doubt the hypothesis that the different cores at the same site and and the different ridges have equal strength means.

MP 2122

DETERIORATION OF FLOATING ICE COVERS.

Ashton, G.D., *Journal of energy resources technology,* June 1985, 107(2), p.177-182, 18 refs. For another source see 38-2020 (MP 1676).
39-3286

ICE DETERIORATION, FLOATING ICE, ICE COVER STRENGTH, ICE MELTING, HEAT TRANSFER, SOLAR RADIATION, ALBEDO, THERMAL REGIME, POROSITY.

The deterioration of floating ice covers is analyzed to determine under what conditions the ice cover loses strength due to internal melting. The analysis considers the interaction between sensible heat transfer and long wave radiation loss at the surface, the surface albedo, the short wave radiation penetration and absorption and the unsteady heat conduction within the ice. The thermal analysis then leads to a determination of the porosity of the ice that allows strength analysis to be made using beam-type analyses. The results provide criteria to determine when and how rapidly the ice cover loses strength and under what conditions it will regain the original strength associated with an ice cover of full integrity.

MP 2123

LABORATORY STUDY OF FLOW IN AN ICE-COVERED SAND BED CHANNEL.

Wuebben, J.L., IAHR Symposium on Ice, 8th, Iowa City, Aug. 18-22, 1986. Proceedings, Vol.1, [1986], p.3-14, 11 refs.
40-4529

CHANNELS (WATERWAYS), ICE COVER EFFECT, WATER FLOW, BOTTOM TOPOGRAPHY, SANDS, FLOW RATE, BOTTOM ICE, SEDIMENT TRANSPORT, TESTS, ANALYSIS (MATHEMATICS).

The objective of this study was to examine the effects of adding an ice cover to flow in a movable bed channel. A series of five tests at four water discharges were conducted in a 36-m-long recirculating flume facility that is 1.2 m wide and 0.6 m deep. After uniform, equilibrium conditions were established for a flow of water with a free surface, essentially identical runs were repeated with the addition of smooth and rough ice covers. All tests were run at room temperature, approximately 19 C, with simulated ice covers. The sediment was a uniform, 0.45-mm-diameter quartz sand and bed forms were in the ripple and dune regimes. The major variables examined in this paper include bed form height, wavelength, Manning's roughness and sediment discharge.

MP 2124

COMPARISON OF TWO CONSTITUTIVE THEORIES FOR COMPRESSIVE DEFORMATION OF COLUMNAR SEA ICE.

Brown, R.L., et al, IAHR Symposium on Ice, 8th, Iowa City, Aug. 18-22, 1986. Proceedings, Vol.1, [1986], p.241-252, 11 refs.
Richter-Menge, J.A., Cox, G.F.N.
40-4549

ICE DEFORMATION, COMPRESSIVE PROPERTIES, ICE CRYSTAL STRUCTURE, SEA ICE, VISCOELASTIC MATERIALS, MODELS, STRESS STRAIN DIAGRAMS, ANALYSIS (MATHEMATICS).

Two constitutive formulations are used to represent the constitutive behavior of columnar sea ice under variable path compressive loadings. The first is a single integral representation which has been successfully used to model viscoelastic materials. This representation is a convenient form for describing nonlinear rate dependent properties and is mathematically more tractable than multiple integral representations or nonlinear differential relations. The second constitutive formulation is an elastic-viscoplastic relation which defines the instantaneous strain rate in terms of several microdynamical variables (compressive mobile dislocation density, tensile mobile dislocation density, and specific microcrack surface area).

MP 2125

FRACTURE TOUGHNESS OF MODEL ICE.

Dempsey, J.P., et al, IAHR Symposium on Ice, 8th, Iowa City, Aug. 18-22, 1986. Proceedings, Vol.1, [1986], p.365-376, 28 refs.
Bentley, D.L., Sodhi, D.S.
40-4558

ICE CRACKS, FRACTURING, ICE STRENGTH, TENSILE PROPERTIES, COMPRESSIVE PROPERTIES, STRESSES, STRAINS.

A wedge-loaded TDCB (tapered double-cantilever-beam) test specimen was used to measure the fracture toughness of model ice. Crack path stability under tensile cracking conditions was ensured by way of the crack-parallel compressive stress provided by the displacement controlled wedge loading. The TDCB specimen size and ice thickness were such that plane strain fracture toughness values were obtained. The influence of crack tip acuity and loading rate were examined.

MP 2126

LABORATORY AND FIELD STUDIES OF ICE FRICTION COEFFICIENT.

Tatinclaux, J.C., et al, IAHR Symposium on Ice, 8th, Iowa City, Aug. 18-22, 1986. Proceedings, Vol.1, [1986], p.389-400, 5 refs.
Forland, K.A., Murdey, D.
40-4560

ICE FRICTION, ICE CRYSTAL STRUCTURE, SURFACE ROUGHNESS, STEEL STRUCTURES, SHEAR STRENGTH, TESTS, AIR TEMPERATURE, PLATES, LABORATORY TECHNIQUES.

Results of laboratory and field tests on the dynamic friction factor between ice (freshwater, urea-doped, and granular or columnar sea ice) and bare or Inerta-coated steel plates of various roughness averages are presented. Laboratory tests were made at three air temperatures, T = -15, -9, and -2 C, with either the ice sample towed over the test plate or a plate sample towed over the ice sheet. All field tests were made at T = -2 C to 0 C. The maximum test velocity was 30 cm/s, and the normal pressure was of the order of 10 kPa. From the test results it is concluded that viscous shear in the meltwater layer between ice and test plate may dominate when the test plate is very smooth, as proposed by Oksanen in his analytical model, but when the material roughness increases, mechanical shear of the ice crystals dominates.

MP 2127

FRAZIL ICE MEASUREMENTS IN CRREL'S FLUME FACILITY.

Daly, S.F., et al, IAHR Symposium on Ice, 8th, Iowa City, Aug. 18-22, 1986. Proceedings, Vol.1, [1986], p.427-438, 9 refs.
Colbeck, S.C.
40-4563

FRAZIL ICE, PARTICLE SIZE DISTRIBUTION, ICE GROWTH, ICE CRYSTAL NUCLEI, ICE MECHANICS.

In a series of recent experiments the dynamic size distribution and concentration of frazil ice crystals were measured in the U.S. Army Cold Regions Research and Engineering Laboratory (CRREL) refrigerated flume facility. These data were found using a crystal imaging system developed at CRREL. The imaging system consists of a circular fiber-optic strobe light, a microscope, and either a high resolution television camera and monitor or a 35 mm camera. The system can observe crystal sizes ranging from 30 micrometers to several millimeters. This system was attached to a movable carriage mounted on the flume. A series of experiments were performed. In each experiment, the size distribution of the frazil crystals was measured as it developed along the length of the flume. The slope of the flume and the bottom roughness of the flume were varied to provide a range of hydraulic conditions. Supercooling levels of 0.01 C to 0.04 C were achieved in the flume and held constant for several hours.

MP 2128

PRELIMINARY STUDY OF A STRUCTURE TO FORM AN ICE COVER ON RIVER RAPIDS DURING WINTER.

Perham, R.E., IAHR Symposium on Ice, 8th, Iowa City, Aug. 18-22, 1986. Proceedings, Vol.1, [1986], p.439-450, 9 refs.
40-4564

ICE GROWTH, ICE COVER, FRAZIL ICE, HYDRAULIC STRUCTURES, ICE DAMS, RIVER ICE, COUNTERMEASURES, FLOODING, TESTS, ICE BOOMS.

The concept of using a trash-rack-like fence across a river to form an overflow weir by accumulating frazil ice was studied. The main purpose of the structure is to create an upstream pool on which a smooth ice cover can form. Laboratory tests in a refrigerated flume provided structural stability guidance and some frazil accumulation experience, with the latter being somewhat inconclusive. Field tests were conducted using a 19-m-long by 1.22-m-high fence boom across two approximately 17-m-wide rivers, one in New Hampshire and one in Vermont.

MP 2129

SUB-ICE CHANNELS AND LONGITUDINAL FRAZIL BARS, ICE-COVERED TANANA RIVER, ALASKA.

Lawson, D.E., et al, IAHR Symposium on Ice, 8th, Iowa City, Aug. 18-22, 1986. Proceedings, Vol.1, [1986], p.465-474, 6 refs.
Chacho, E.F., Brockett, B.E.
40-4566

RIVER FLOW, SUBGLACIAL DRAINAGE, CHANNELS (WATERWAYS), FRAZIL ICE, RIVER ICE, ICEBOUND RIVERS, ICE BOTTOM SURFACE, SEDIMENT TRANSPORT, VELOCITY, UNITED STATES—ALASKA—TANANA RIVER.

Repetitive surveys and measurements from 1983 through 1986 of the ice-covered Tanana River near Fairbanks, Alaska, have shown that flow occurs in sub-ice channels that are separated by longitudinal bars composed of stratified, partly consolidated frazil ice of varying type and distribution. In contrast to hanging dams, these frazil bars extend up- and downstream parallel to flow as well as from the base of the ice cover to the bed, and act as lateral walls for the sub-ice channels. Individual sub-ice channels may branch and reunite, thus forming a braided pattern beneath the ice cover. Longitudinal frazil bars apparently develop at locations characterized by lower velocities, such as where currents are diverted by irregularities in the bed or in the base of the ice cover.

MP 2130

FRAZIL ICE PEBBLES: FRAZIL ICE AGGREGATES IN THE TANANA RIVER NEAR FAIRBANKS, ALASKA.

Chacho, E.F., et al, IAHR Symposium on Ice, 8th, Iowa City, Aug. 18-22, 1986. Proceedings, Vol.1, [1986], p.475-483, 4 refs.
Lawson, D.E., Brockett, B.E.
40-4567

FRAZIL ICE, ICE MECHANICS, ICE GROWTH, AGGREGATES, GRAIN SIZE, ABRASION, UNITED STATES—ALASKA—TANANA RIVER.

A unique form of frazil ice aggregate, the frazil ice pebble, occurs in large quantities in the Tanana River near Fairbanks, Alaska. Frazil pebbles consist of a mixture of individual particles, including other aggregates, which are bound together to form a consolidated, compact mass that is similar in appearance to water-worn stream pebbles. Frazil pebbles have been found incorporated into the ice cover, in transport beneath the ice cover and in frazil deposits. They range in length from less than 5 mm to greater than 150 mm. Internally, grains composing the frazil pebbles do not possess a preferred C-axis orientation, but appear to show an alignment related to grain size and shape.

MP 2131

POTENTIAL SOLUTION TO ICE JAM FLOODING: SALMON RIVER, IDAHO.

Earickson, J., et al, IAHR Symposium on Ice, 8th, Iowa City, Aug. 18-22, 1986. Proceedings, Vol.2, [1986], p.15-25, 10 refs.
Zufelt, J.E.
40-4581

ICE JAMS, FLOODING, WATER LEVEL, FLOOD CONTROL, FREEZEUP, RIVER ICE, ICE CONTROL, DESIGN, ICE BOOMS, UNITED STATES—IDAHO—SALMON RIVER.

The uppermost 140 miles of the Salmon River generates great quantities of frazil ice throughout Idaho's cold winters. A freeze-up ice jam forms at a slackwater region 27 miles downstream of the city of Salmon, Idaho every winter, and often progresses upstream to the city. As the ice jam moves through Salmon, the river level can rise 6 to 8 feet and cause extensive flooding. Flooding has occurred at least 32 times since 1900, and the 1982 flood caused $1,000,000 in damages.

MP 2132

DESIGN AND MODEL TESTING OF A RIVER ICE PROW.

Tatinclaux, J.C., IAHR Symposium on Ice, 8th, Iowa City, Aug. 18-22, 1986. Proceedings, Vol.2, [1986], p.137-150, 16 refs.

40-4591

ICE NAVIGATION, RIVER ICE, ICE CONDITIONS, ICE BREAKING, DESIGN, DAMS, LOCKS (WATERWAYS), MODELS, TESTS.

One of the tasks in the Corps of Engineers River Ice Management (RIM) program is to develop an ice prow capable of creating nearly ice-free channels in the vicinity of locks and dams on the Illinois and Ohio Rivers. Based on a literature survey the selected concept was that of a barge type attachment to be mounted ahead of a towboat. The prow is equipped with ice knives, and has a gently sloping bottom equipped with deflector vanes. The paper presents the results of model resistance tests which served to select the vane configuration and number of ice knives. A prototype of the prow is under final design for construction; field testing and demonstration are scheduled for winter 1986-87.

MP 2133

BUBBLERS AND PUMPS FOR MELTING ICE.

Ashton, G.D., IAHR Symposium on Ice, 8th, Iowa City, Aug. 18-22, 1986. Proceedings, Vol.2, [1986], p.223-234, 8 refs.

40-4597

ICE MELTING, BUBBLING, WATER TEMPERATURE, PUMPS, WATER FLOW, HYDRAULIC JETS, ANALYSIS (MATHEMATICS).

Air bubbling systems and submerged pumps have both been used to induce a jet-like flow of warm water against the underside of ice sheets resulting in ice melting. The mechanics of air bubbling systems for this purpose has been analyzed previously and analytical methods are available to evaluate their effectiveness. A similar analysis of the melting caused by pump systems is presented. A comparison of the effectiveness of bubblers and pumps is made in terms of power. Finally the advantages and disadvantages of the two kinds of systems are contrasted.

MP 2134

FLEXURAL AND BUCKLING FAILURE OF FLOATING ICE SHEETS AGAINST STRUCTURES.

Sodhi, D.S., IAHR Symposium on Ice, 8th, Iowa City, Aug. 18-22, 1986. Proceedings, Vol.2, [1986], p.339-359, Refs. p.356-359.

40-4604

FLOATING ICE, ICE STRENGTH, OFFSHORE STRUCTURES, FLEXURAL STRENGTH, ICE PRESSURE, ICE SOLID INTERFACE, ICE DEFORMATION, ICE SHEETS, STRESSES, ICE COVER THICKNESS, ICE ADHESION.

This is a review of work on bending and buckling failure of floating ice sheets, along with the forces generated during ice/structure interaction. The focus is on the work published after 1980. Estimation of ice forces as a result of bending and buckling failure of an ice sheet can be made with a fair degree of confidence when the ice/structure interaction leads to one of the two modes of failure. The problem of multimodal failure of floating ice sheets needs further study.

MP 2135

COLD CLIMATE UTILITIES MANUAL.

Smith, D.W., ed, Montreal, Canadian Society of Civil Engineering, 1986, var.p., Refs. passim.

Reed, S.C.

40-4633

COLD WEATHER CONSTRUCTION, COLD WEATHER OPERATION, ENGINEERING, UTILITIES, WATER TREATMENT, WASTE DISPOSAL, PIPELINES, HEAT LOSS, MANUALS, ENVIRONMENTAL PROTECTION.

MP 2136

SEA ICE PROPERTIES.

Tucker, W.B., III, et al, *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* Oct. 1984, SR 84-29, MIZEX: a program for mesoscale air-ice-ocean interaction experiments in Arctic *marginal ice zones. 5: MIZEX* 84 summer experiment PI preliminary reports. Edited by O.M. Johannessen and D.A. Horn, p.82-83, ADA-148 986.

Gow, A.J., Weeks, W.F.

40-4700

ICE PHYSICS, SEA ICE, ICE CORES, ICE FLOES, ICE STRUCTURE, ICE SAMPLING, ABLATION, SNOW COVER EFFECT.

MP 2137

***IN-SITU* THERMOCONDUCTIVITY MEASUREMENTS.**

Faucher, M., *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* 1986, SR 86-01, Technology transfer opportunities for the construction engineering community: materials and diagnostics, p.13-14, ADA-166 360.

40-4705

THERMAL CONDUCTIVITY, THERMISTORS, SOIL PHYSICS, CONSTRUCTION MATERIALS, MEASURING INSTRUMENTS.

MP 2138

ROOF BLISTER VALVE.

Korhonen, C., *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* 1986, SR 86-01, Technology transfer opportunities for the construction engineering community: materials and diagnostics, p.29-31, ADA-166 360.

40-4706

ROOFS, LEAKAGE, DAMAGE, COUNTERMEASURES, WEATHERING.

MP 2139

AIRBORNE ROOF MOISTURE SURVEYS.

Tobiasson, W., *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* 1986, SR 86-01, Technology transfer opportunities for the construction engineering community: materials and diagnostics, p.45-47, ADA-166 360.

40-4707

ROOFS, MOISTURE DETECTION, AIRBORNE EQUIPMENT, MAINTENANCE.

MP 2140

PROTECTED MEMBRANE ROOFING SYSTEMS.

Tobiasson, W., *U.S. Army Cold Regions Research and Engineering Laboratory. Special report,* 1986, SR 86-01, Technology transfer opportunities for the construction engineering community: materials and diagnostics, p.49-50, ADA-166 360.

40-4708

ROOFS, INSULATION, PROTECTION, SOLAR RADIATION, DRAINAGE, DAMAGE.

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